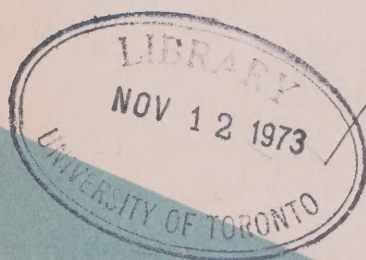


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Government
Publications

SOUTH SASKATCHEWAN RIVER



REPORT

Canada

OF THE ROYAL COMMISSION ON THE
SOUTH SASKATCHEWAN RIVER PROJECT

120°

115

110°

SOUTH SASKATCHEWAN RIVER PROJECT

Scale in Miles

50 0 50 100 150 200

55°

ALBERTA

SASKATCHEWAN

EDMONTON

CALGARY

SWIFT CURRENT

MEDICINE HAT

U.S.A.

Paul-H. Laurendeau, geographer-cartographer

115°

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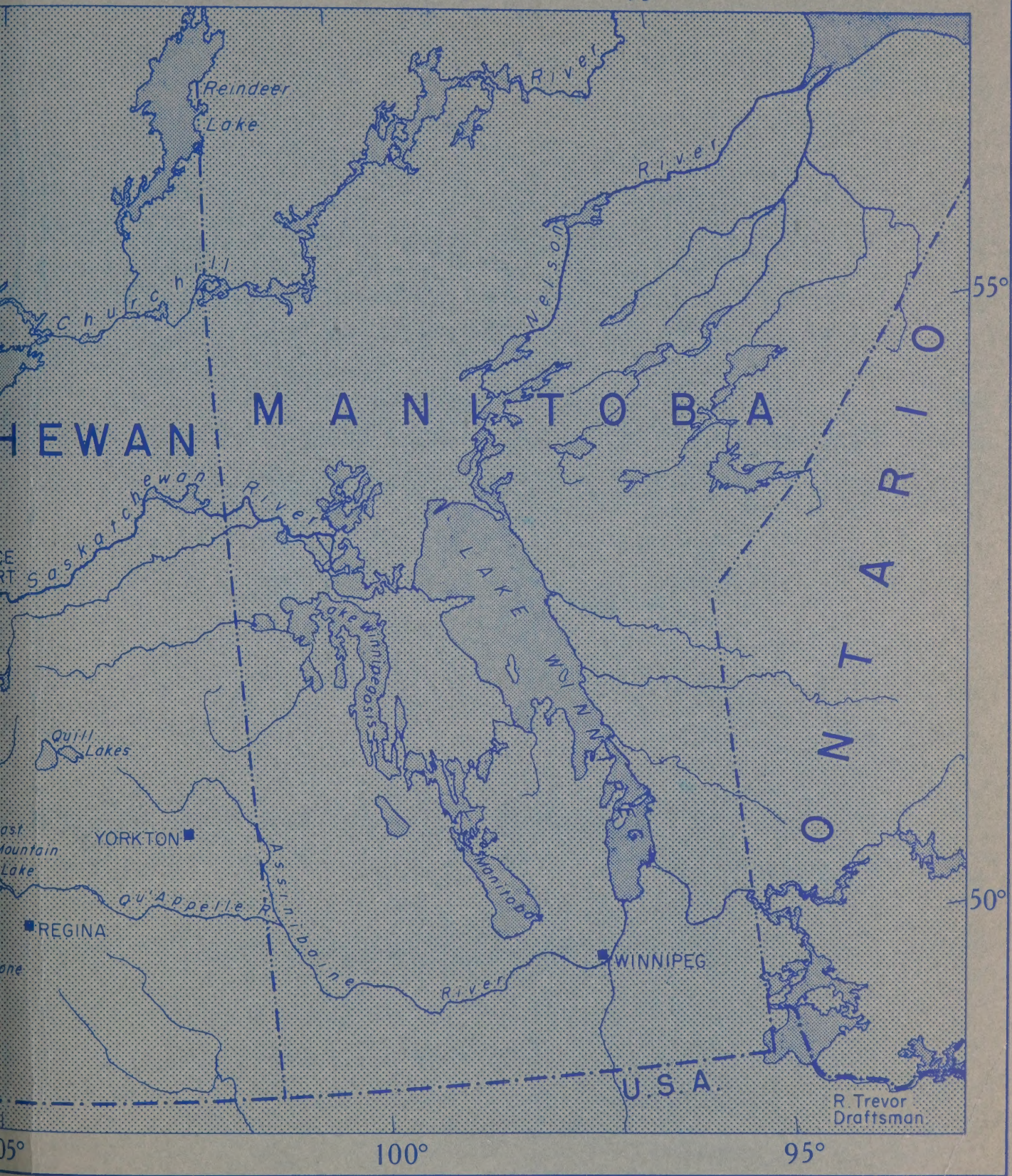
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IAN BURTON

**Report of the
Royal Commission on the
South Saskatchewan River Project**

R E P O R T

of the

Royal Commission

on the

South Saskatchewan River

Project

1952

**EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1952**

Royal Commission
on the
South Saskatchewan River Project
1952

COMMISSIONERS

DR. T. H. HOGG, *Chairman*

G. A. GAHERTY, ESQ.

DR. JOHN A. WIDTSOE

B. T. RICHARDSON, ESQ.,
Secretary

GORDON HAASE, ESQ.,
MISS M. ANN MOSLEY
Assistant Secretaries

D. W. HAYS, ESQ.,
Engineering Consultant

J. J. CONNOLLY, ESQ., Q.C.
Commission Counsel

H. CARL GOLDENBERG, ESQ., Q.C.
Special Counsel

A dam, 85 feet high, and 600 to 800 yards long (a few miles lower down the length of the dam would be much less) across the deep narrow valley in which the South Branch flows, below where the Qu'Appelle valley joins it, would send its waters down the Qu'Appelle valley, thence down the Assiniboine past Fort Garry, and thus establish a splendid and probably uninterrupted navigation, for steamers of large size, for a distance exceeding six hundred miles.

—The first proposal to construct a dam in the South Saskatchewan River, made by Henry Youle Hind, M.A., in his Report on the Assiniboine and Saskatchewan Expedition, 1859.

Report

To His Excellency the Governor General in Council

MAY IT PLEASE YOUR EXCELLENCY,

We, the Commissioners, appointed as a Royal Commission in accordance with the terms of an Order in Council dated 24th August, 1951, to conduct an inquiry and to report on the South Saskatchewan River Project (Central Saskatchewan Development):

BEG TO SUBMIT TO YOUR EXCELLENCY
THE FOLLOWING REPORT

The Order in Council

P.C. 4435

Privy Council
[Seal]
Canada

*Certified to be a True Copy of a Minute of a Meeting of
the Committee of the Privy Council, Approved by His
Excellency the Governor General on the 24th August, 1951.*

The Committee of the Privy Council, on the recommendation of the Right Honourable Louis S. St. Laurent, the Prime Minister, advise:

1. That under and in pursuance of Part One of the Inquiries Act a commission do issue appointing Commissioners to conduct an inquiry into the following matters, namely:

Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;

Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

2. That the following persons be appointed Commissioners pursuant to Part One of the Inquiries Act to conduct the said inquiry:

Dr. T. H. Hogg, Toronto, Ontario,
Mr. G. A. Gaherty, Calgary, Alberta, and
Dr. John A. Widtsoe, Salt Lake City, Utah, U.S.A.

3. That the said Dr. T. H. Hogg be Chairman of the Commission;

4. That Mr. Burton T. Richardson, Ottawa, Ontario, be Secretary to the Commissioners;

5. That for the purposes hereinabove stated, the Commissioners shall have all the powers vested in, or which can be conferred on Commissioners under the Inquiries Act, that all or any of the powers which can be conferred under Part Three of the Inquiries Act may be exercised by any two of the Commissioners, and that departments of the Government of Canada shall afford the Commissioners, and all persons acting under their authority, or by their direction, such assistance and co-operation in the matters of the inquiry as the Commissioners may think desirable;

6. That the Commissioners be further authorized to include in their examination and to report upon all matters which the Commissioners may consider pertinent or relevant to the general scope of the inquiry.

(Signed)

A. M. HILL

Asst. Clerk of the Privy Council.

Commission

appointing

DR. T. H. HOGG, G. A. GAHERTY, Esquire,

and DR. JOHN A. WIDTSOE,

Commissioners under Part I of the Inquiries Act
to inquire into and report upon the feasibility
of the South Saskatchewan River project.

DATED, 24th August, 1951

RECORDED, 25th September, 1951

Lib. 467, Fol. 358

(s) H. W. DOYLE
for DEPUTY REGISTRAR GENERAL OF
CANADA

Refer. No. 135612

Commission of Appointment

(s) R. J. CARTWRIGHT
DEPUTY GOVERNOR GENERAL
CANADA

[SEAL]

GEORGE THE SIXTH, by the Grace of God, of Great Britain, Ireland and the British Dominions beyond the Seas, KING, Defender of the Faith.

(s) PAUL FONTAINE
(for)
DEPUTY ATTORNEY GENERAL
CANADA

TO ALL TO WHOM these Presents shall come or whom the same may in anywise concern,

GREETING:

WHEREAS pursuant to the provisions of Part I of the Inquiries Act, Revised Statutes of Canada, 1927, Chapter ninety-nine, His Excellency the Governor General in Council by Order P.C. 4435 of the Twenty-fourth day of August, in the year of Our Lord one thousand nine hundred and fifty-one, a copy of which is hereto annexed, has authorized the appointment of Our Commissioners therein and hereinafter named to investigate and report:

- (1) Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;
- (2) Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

and has conferred certain rights, powers and privileges upon Our said Commissioners as will by reference to the said Order more fully appear.

Now KNOW YE that by and with the advice of Our Privy Council for Canada, We do by these Presents nominate, constitute and appoint DR. T. H. HOGG, of the City of Toronto, in the Province of Ontario, G. A. GAHERTY, ESQUIRE, of the City of Calgary, in the Province of Alberta, and DR. JOHN A. WIDTSOE, of Salt Lake City, in the State of Utah, United States of America, to be our Commissioners to conduct such inquiry.

To HAVE, HOLD, EXERCISE and ENJOY the said office, place and trust unto the said T. H. HOGG, G. A. GAHERTY and JOHN A. WIDTSOE together with the rights, powers, privileges and emoluments unto the said office, place and trust, of right and by law appertaining, during pleasure.

AND WE do hereby further appoint the said T. H. HOGG to be Chairman of Our said Commissioners.

IN TESTIMONY WHEREOF We have caused these Our Letters to be made Patent and the Great Seal of Canada to be hereunto affixed.

WITNESS: Our Right Trusty and Well-beloved Counsellor the Honourable John Robert Cartwright, Puisne Judge of the Supreme Court of Canada and Deputy of Our Right Trusty and Well-beloved Cousin, Harold Rupert Leofric George Viscount Alexander of Tunis, Knight of Our Most Noble Order of the Garter, Knight Grand Cross of Our Most Honourable Order of the Bath, Knight Grand Cross of Our Most Distinguished Order of Saint Michael and Saint George, Companion of Our Most Exalted Order of the Star of India, Companion of Our Distinguished Service Order, upon whom has been conferred the Decoration of the Military Cross, Field Marshal in Our Army, Governor General and Commander-in-Chief of Canada.

AT OUR GOVERNMENT HOUSE, in Our City of Ottawa, this Twenty-fourth day of August in the year of Our Lord One thousand nine hundred and fifty-one and in the Fifteenth year of Our Reign.

BY COMMAND

(s) C. STEIN

UNDER SECRETARY OF STATE

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PART I

Recommendations and General Considerations

Recommendations and General Considerations

1. The Commission was established to inquire whether the economic and social benefits of the South Saskatchewan River Project would be commensurate with the cost and whether the Project represents the most profitable and desirable use which can be made of the physical resources involved. The Commissioners were also authorized to inquire into and report upon all other matters which they deemed pertinent to their inquiry. The purpose of the South Saskatchewan River Project is to irrigate an estimated 455,000 acres of land in Central Saskatchewan by constructing a dam 205 feet in height across the South Saskatchewan River near Outlook, the site being just above the mouth of Coteau Creek. Associated with the plans for irrigation, it is proposed to develop 150,000 horsepower at the dam, part of which would be used to pump water to heights of from 15 to 120 feet to irrigate approximately 307,000 acres of the total area. It includes provision for supplying water for domestic use, greatly needed in the cities of Moose Jaw and Regina.

2. The Canadian Prairie Provinces, in which 123,000,000 acres are in occupied farms, include an area, roughly triangular in shape, in which the problems arising from low rainfall are exceptionally acute. This area extends along the international

border south of Estevan, Saskatchewan, to the vicinity of Lethbridge, Alberta, and has its apex to the west of Saskatoon, roughly in the neighborhood of Macklin, Saskatchewan. It was first explored in 1857-60 by Captain John Palliser of the Royal Engineers and declared to be arid and unpromising for human habitation. It is commonly known as Palliser's Triangle. It includes some lands that are farmed successfully by modern dry farming methods and some areas of consistent crop failure. In seasons of drought, the failure of crops often extends beyond its confines. In the heart of Palliser's Triangle is an inner triangle, possibly amounting to 15,000,000 acres lying both in Saskatchewan and in Alberta. Some lands therein once were tilled, and are now abandoned. In the inner triangle, the problem is one of reclamation of land which, without irrigation to supplement rainfall, will likely remain of little value for agriculture. Elsewhere the benefit of irrigation is to increase and stabilize the yield of lands already being farmed with more or less success.

3. Where the annual precipitation is deficient great benefit often accrues if supplementary water is provided. All the water of the South Saskatchewan River and all that could be diverted from the North Saskatchewan, however, would irrigate only

3,000,000 acres, more or less. At present there are 610,000 acres under irrigation and 450,000 more will be irrigated when works now planned and under construction are completed. It is evident that only a small proportion of the lands that could be made more productive with supplementary water can be irrigated. The limit of water supply from streams in the Saskatchewan River Basin may be reached in the foreseeable future. Water is one of the most important resources of the region available for enlarging and stabilizing its agriculture.

4. The topography of Palliser's Triangle makes irrigation costly. The main rivers traverse the region in wide valleys from three to five hundred feet below the general ground level. To command the uplands, the water must be diverted far upstream and conveyed in long canals to points of use. Otherwise, high dams must be constructed in deep valleys, where foundation conditions generally are uncertain, or the water must be pumped to heights that are likely to be beyond the economic limits of cost. To discover the best alternative, comprehensive Basin-wide investigation and planning are indispensable.

5. Much investigation and development have been carried out by official agencies such as the former Reclamation Service and the administration of the Prairie Farm Rehabilitation Act, as well as by irrigation districts and former private companies. Further agronomic and engineering studies are a prerequisite to determine where irrigation will be the most productive and where the cost of irrigating is economic. While the best use of water is an urgent consideration in the Saskatchewan River Basin,

the problem has not been understood in its broadest aspects, nor have solutions to it been conceived in terms of the fullest ultimate use of available water. The scope of the problem is vast so that the selection of projects for water utilization must take into account the general public interest as well as sectional claims.

6. Apart from the cost of bringing water to the farm, irrigation involves extra cost and work on the part of the farmer in distributing the water over his land. Wheat is not generally a profitable crop on irrigated land. Provided the water is furnished at reasonable cost, irrigation can be carried out on a grain-hay-livestock basis and this fits in well with pasturage on adjacent dry lands. The irrigation of specialty crops such as sugar beets and canning vegetables will stand much higher water charges. But the market for such crops in the area in question is at present too small to be much of a factor. Irrigation produces a stable agricultural economy within the limits of a project but the benefits to agriculture cannot be expected to extend much beyond the irrigated area.

7. Irrigation is a consumptive use of water, though it is only one use to which the flow of a river may be put. The development of large irrigation projects where they are desirable will foreclose other uses, such as hydro-electric power schemes lower down on the same river. Equally, the development of power plants on the lower reaches of the Saskatchewan River would create perpetual claims upon the flow which could not be disregarded when the need arises for

an expansion of irrigated acreage in the arid region through which the South Branch of the river passes.

8. For irrigation there is no substitute for water whereas for generating power there are alternatives. The proposal to commit for hydro-electric power approximately four-fifths of the flow of the South Saskatchewan River at the Coteau Creek damsite, where it could never be returned for irrigation in the arid territory above the site, would scarcely survive as part of a program of integrated development of the Basin directed to the ultimate objective of utilizing the full flow for irrigating the dry lands of Western Canada. Moreover, the large scale abstractive use of water for irrigation in eastern Alberta and western Saskatchewan would be at the expense of a serious loss of hydro-electric power at undeveloped sites on the lower Saskatchewan and Nelson Rivers.

9. The economy of the Prairies and particularly of Saskatchewan has obvious weaknesses. Although the average production per farmer over the years compares favourably with that of the rest of Canada, the vagaries of climate result at times in crop failures which in extreme cases extend beyond the confines of Palliser's Triangle. This creates relief problems and, as Saskatchewan's brief put it in a striking phrase, "the immeasurable destitution of the land and its people." The wheat crop of Saskatchewan, which is the Province's principal source of wealth, has fluctuated from 36,000,000 to more than 400,000,000 bushels. In addition, the mechanization of the wheat farm has contributed to the depopulation of the countryside. "As a result of these

conditions", the brief said, "private business and public services, both municipal and provincial, are under a constant threat of disruption."

10. Argument advanced on behalf of the Project at the hearings of the Commission in Saskatchewan stressed the disastrous economic and social consequences of these conditions upon the life of the people of Saskatchewan. The Saskatchewan submission said: "There is a great need, firstly, for assured feed supplies to permit diversification of the economy through livestock production and, secondly, for new land on which to settle insecure farmers. Neither of these needs can be adequately filled without the Central Saskatchewan Development." The problem is so complex and so far-reaching in its implications that the Commission feels constrained to point out that the remedies would lead far beyond its terms of reference. A word of caution is required against excessive expectation that this problem can be solved by one bold stroke. The economy of Saskatchewan is vulnerable through being restricted in large degree to one-crop agriculture. This condition may be ameliorated by industrial development in the Province, by diversified land use as a result of changing demands for farm products, and by the exploitation of the resources of forest and mineral regions in the north.

11. The lands it is proposed to irrigate by the South Saskatchewan River Project lie on the northeastern fringe of Palliser's Triangle. There those farmers who are successfully farming large acreages by dry farming methods are unlikely in many cases to take kindly to having their farms broken

up into small blocks suitable for irrigation. This has been the experience in irrigation projects elsewhere. There are cases where dry land farmers have successfully resisted plans to incorporate their holdings into irrigation developments. How the large holdings in the Project would be made available in small blocks for irrigation was not discussed at the Commission's hearings. Nevertheless, the territory included in and affected by the Project would be helped greatly by irrigation. If it came into successful operation, it would have favourable effects on the economy of the Province. It would provide opportunities and amenities to attract new population.

12. From studies of the Project the soils are suitable and the amount of water available is adequate for irrigation development. However, the land is situated in a climatic zone that imposes limitations on the crops that can be grown. Furthermore, a readily available market for specialty crops is not apparent at this time.

13. The Project is so situated as to require water to be pumped to heights of 15 to 120 feet to irrigate about two-thirds of the gross irrigable area. This would materially increase operational costs. It is doubtful whether the farmers in all areas would be amenable to such high costs for irrigation, in view of the competing attraction of dry farming opportunities which exist within the Project.

14. The risk of a failure of sustained irrigation for all parts of the Project, such as has occurred in certain irrigation projects in Alberta where over 150,000 acres of irrigated land have reverted to dry farming, warns that the cause of irrigation would

receive a set-back from which it would take years to recover, if the Project were undertaken in the light of mistaken judgment.

15. Estimates of the period required to construct the Project range upwards from a minimum of six and a half years. The development of the irrigation areas to a point approximating maturity would require from 35 to 50 years. Maximum returns, therefore, would be deferred for a long period of time.

16. Reports of the Prairie Farm Rehabilitation Administration and its advisers, eminent engineers in this field, assert that the Coteau Creek Dam can be constructed successfully. This question is not specifically included in the terms of reference. In view of the unfavourable foundation and other conditions at the site and the costly construction difficulties that might therefore be expected in building a high dam there, the Commission did concern itself with the cost of a structure that would be safe. Even where construction is less hazardous, the cost is apt to be underestimated, as in the St. Mary-Milk River Project where the anticipated final cost of \$45,000,000 compares with an original estimate of \$15,000,000.

17. The Commission is of the opinion that the South Saskatchewan River Project would cost at least \$250,000,000, of which the Coteau Creek reservoir and power station would represent \$175,000,000. Deducting \$30,000,000 for the value of the power development and allowing \$20,000,000 for the value of social and other benefits, including the domestic water supply of the cities of Regina and Moose Jaw, the remaining cost chargeable to irrigation would be over \$70,000 for each farm unit. On the basis

of the agreement on the division of costs of large irrigation projects set out in P.C. 2298, June 19, 1947, the share of the Province of Saskatchewan for the power plant, the irrigation system including pumping installations, and the cost of land acquisition in the irrigable area would be some \$100,000,000.

18. That costs of this order are to be expected is indicated by a recent estimate of \$290,000,000 for the Garrison reservoir and power station now being built on the Missouri River by the U.S. Corps of Engineers. Although the structure is somewhat larger, geological and topographical conditions are generally similar. This estimate includes no provision for irrigation.

19. The economic value of water power is determined by the cost of producing power from alternative available sources. The cost of providing power facilities at the Coteau Creek Dam is such that Saskatchewan's power needs can be provided almost as cheaply from steam plants situated near the main load centres or near low cost sources of fuel. The development of power at the proposed Coteau Creek Dam can, therefore, have little significance in the consideration of the South Saskatchewan River Project.

20. Construction of the Project under conditions approaching full employment would force the curtailment of other productive efforts. There is no justification for denying to the Canadian consumer the benefit of productive activities that would be curtailed if the Project were undertaken under present conditions. A need for new employment opportunities and conditions in which new public investment would not

create inflationary pressure upon the price level, would favour the Project, always assuming that it would not foreclose more profitable and desirable plans of Basin development.

21. Three main considerations have influenced the Commission:

A. The cost of the South Saskatchewan River Project would be large.

The total cost of the Project would tend to place too great a burden upon the land or upon the farmer. The cost to the farmers of converting existing dry land into irrigated farms must be kept within reasonably well understood limits. Equally, the cost to the taxpayer must be kept within limits. The cost of the Project is so high that the Commission is confident that irrigation farms can still be created, as they have in the past, at less cost elsewhere in the Saskatchewan River Basin. While the cost of the Project needs to be considered in part a subsidy, it should not be regarded as a private investment in which the main concern would necessarily be the recovery of capital with interest in the usual fashion. Indirect returns from public investment are substantial, even though they cannot be accounted for strictly in dollars and cents. Public investment undertaken with proper safeguards and foresight, is necessary in order to achieve the broad aims of nation building. There are large and satisfactory returns to be secured, which add to the economic expansion of the country and contribute to social

progress. It remains a question in the Commission's mind to what extent such subsidy as may be required for the South Saskatchewan River Project, may be justified by anticipated demands for agricultural land and increased food production.

B. *Other projects seem likely to afford a more profitable and desirable use of the physical resources involved.* While some agronomic aspects of the Project favour a decision to launch irrigation enterprises in the Project area, particularly in the southern portions of it, the evidence suggests that greater benefits may be obtained elsewhere from comparable investment in irrigation. Comparable investment in the use of the water upstream may prove more profitable, especially if it made possible the irrigation of land

which is extremely dry and which is not occupied by dry land farmers who would have to be closed out.

C. *A realistic nation-wide approach is needed.* Back of all planning and discussions of such an undertaking as the South Saskatchewan River Project must lie the feeling that all parts of Canada have equal rights in seeking full development. Canadians shall fail if they do not view the development of Saskatchewan as one of the vital parts of the development of Canada. The Commission feels that the development of irrigation in Central Saskatchewan is essentially a task of statesmanship involving the provision of lands and social amenities for generations of contented, useful citizens.

Findings and Recommendations

1. The Commission finds that at present the economic returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) are not commensurate with the cost thereof; though the Project would yield social returns which, while they cannot be measured for the purpose of this Report, would be of great value to the region in which it is situated.

2. The Commission recommends that, when the time comes that the Project

represents the then best use of water for irrigation, the present finding should be reviewed in the light of changing conditions. Among others, the following considerations might then be taken into account:

- (a) The prospect of adequate markets for the specialty crops, such as sugar beets, canning vegetables, potatoes, etc., that could be grown on the area it is proposed to irrigate;
- (b) The Canadian demand for farm products which, when it comes more nearly

into balance with production, would require a more intensive use of land resources;

- (c) A significant change in relationship of the price of farm products and construction costs;
- (d) The necessity for the construction of public works for the relief of unemployment.

3. The Commission finds that the available data, which are by no means complete, indicate that the said Project does not represent the most profitable and desirable use which can be made of the physical resources involved.

4. The Commission recommends, in respect to No. 3 above, that further study be given to the merits of:

- (a) Irrigating the area that needs water most, namely, the arid core of the region known as Palliser's Triangle, which lies in eastern Alberta and western Saskatchewan;
- (b) Bringing additional land under irrigation in the Saskatchewan River Basin by pumping water direct from the River and from existing irrigation canals or extensions thereof;
- (c) The development known as the Red Deer River Project, including its possible extension into the Province of Saskatchewan.

5. The Commission finds that the future demand for water for irrigation could be such as to exhaust the available flow of the South Saskatchewan River, and recommends, therefore, that without delay a comprehensive, long-range program be developed that would result, over the years, in the most beneficial use being made in the

interests of the people of Canada of the waters of the Saskatchewan River from its head waters to the sea.

6. The Commission finds that to implement a Basin program, the conflict between the upstream consumptive use of the water for irrigation and its downstream use for generating power will have to be resolved.

7. The Commission recommends, in respect to No. 5 above that:

- (a) The requisite data be gathered by the appropriate governmental services, Federal and Provincial;
- (b) Agronomic and engineering studies be made in respect to all potentially irrigable areas within the Saskatchewan River Basin;
- (c) The feasibility be determined of augmenting the water supply available for irrigation by means of a diversion of the North Saskatchewan River above Rocky Mountain House into the Clearwater River and, in turn, into the Red Deer River;
- (d) Studies be inaugurated to determine the effects of existing and future irrigation projects in Alberta and Saskatchewan upon the development of power downstream on the Saskatchewan and Nelson Rivers;
- (e) The possibility be explored of making good in part any reduction in hydro-electric power arising from the upstream consumptive use of water for irrigation, by means of a diversion from the Athabasca River Basin into the North Saskatchewan River and also by a diversion from the Churchill

River by way of the Sturgeon-Weir River into the Saskatchewan Basin;

- (f) The Government of Canada make available appropriate administrative and other machinery for collecting and correlating relevant data for making the required studies and for developing and coordinating a Basin program.

8. The Commission recommends, having regard particularly to the needs of the Province of Saskatchewan, that immediate consideration be given to:

- (a) The development of the resources of the Qu'Appelle River Valley by providing adequate facilities to pump water from the South Saskatchewan River or by other means, in order to furnish municipal water supplies for the cities of Regina and Moose Jaw and to realize within economic limits all irrigation benefits and social and recreational opportunities therein.
- (b) The irrigation of lands in Central Saskatchewan within reach of the South Saskatchewan River by pump-

ing water direct from the River wherever economically feasible.

9. The Commission recommends that early consideration be given to the reclamation by dyking and drainage of some 100,000 acres in the area known as the Pasquia Project, as a first step in the reclamation of fertile delta lands lying at the forks of the Carrot, Pasquia and Saskatchewan Rivers, in order to encourage the orderly, integrated development of an agricultural region that is likely to be of crucial importance in the mineral and industrial development of northern Manitoba and Saskatchewan. Development of delta lands would provide re-settlement opportunities that are greatly needed and which can be met to a limited degree only by irrigation development.

10. The Commission recommends that irrigation projects that are under construction and possible extensions thereto should be pushed to completion, and that early investigations be made of such projects as may be constructed at a reasonable cost so that the development of irrigation may proceed as rapidly as is consistent with economic conditions and agricultural needs.

General Considerations

1. The Commission was established by P.C. 4435 on August 24th, 1951, to inquire into the following:

Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;

Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

The following paragraph is of importance:

That the Commissioners be further authorized to include in their examination and to report upon all matters which the Commissioners may consider pertinent or relevant to the general scope of the inquiry.

2. In determining whether the economic and social benefits of the South Saskatchewan River Project would be commensurate with the cost thereof, the Commission has had much help from the engineering and other researches begun by the Prairie Farm Rehabilitation Administration in 1943 and carried on continuously since 1947. Few proposals of public investment have had the advantage of preliminary study on the extensive scale given to this Project by the P.F.R.A. Engineering studies of possible sites had guided the selection of a site for a dam on the river below the Alberta boundary and had fixed in general the design of the structure. In addition, the reports available to the Commission dealt in a comprehensive way with climate, soils, power, economic benefits, land and development policy, the development of irrigation in Alberta, and recreational aspects. Without this excellent and exhaustive material, which represented many months of painstaking and, in some instances, original research, the Commission's task would have been impossible.

3. The P.F.R.A. reports were presented to Parliament on September 7, 1950 (Sessional Paper 95A). A summary of these reports was tabled on June 29, 1951. It was necessary, for the Commission's purpose, to examine this information in detail at the outset. At the same time, the Commission was bound by the terms of reference to consider the broad question whether the Project represents the most profitable and desirable use which can be made of the physical resources involved.

4. The first part of the reference compelled the Commission to examine the South Saskatchewan River Project with special refer-

ence to the benefits it would confer upon the Canadian people and, as well, its cost.

~~†~~In order to determine whether benefits are "commensurate" with cost, it appeared that an attempt should be made to draw up a balance sheet setting out returns on one side and costs on the other. The obvious limitation of this method was that, while direct economic returns are measurable, the indirect economic benefits and the social values cannot be reduced to dollars and cents. Yet by estimating as closely as possible those benefits that can be measured, and by analyzing the cost in the light of the best available engineering knowledge and experience in construction, the Commission has sought to show the approximate figure at which the indirect economic and social benefits would have to be valued to effect a balance of costs and returns.

5. The question of the engineering feasibility of the Coteau Creek Dam did not enter into the Commission's inquiry, except insofar as the Commissioners undertook to satisfy themselves on the general details of an undertaking that involves some uncommon engineering problems. There are obvious difficulties in the creation of a reservoir on the South Saskatchewan River where the P.F.R.A. has selected its site, and the safety of the structure would be a matter of concern to its builders. The works to be constructed would exceed any comparable engineering project in Canada, and would compare with like projects constructed in a similar environment in the United States. The foundations upon which the large dam would rest are hardly the sort which engineers would choose if an alternative site existed. The Project requires a heavy

structure to be built upon 80 to 100 feet of detritus, consisting of silt, sand, gravel and rock of the river bottom. The problem of de-watering during a long period of construction, in which exceptionally high water levels may recur, presents some grave risks. In terms of cost, a substantial over-run of estimates can be expected, and the cost must be indeterminate until the construction of such a Project would be complete. For these reasons, the Commissioners had to satisfy themselves that the estimate of cost was made on a sound basis.

6. Public investment, moreover, must take into account not only the financial cost of a project, but also its real cost in terms of competing demands upon the resources of Canada and the relative value of realizable benefits. This aspect of the inquiry, like several other aspects of crucial importance, had not been investigated prior to the Commission's inquiry. In half a century, an aggregate expenditure of \$85,000,000 has brought more than 600,000 acres of dry land under irrigation from the tributaries of the South Saskatchewan River. Yet the Commission discovered that there had been relatively little prior inquiry into the economic and social values of capital expenditures of this kind. The economic literature dealing with investment in irrigation in Canada remains today remarkably slight. It became obvious to the Commission, that, to discharge properly the duty laid upon it by the terms of reference, its inquiry would have to be extended beyond the limits that first appeared appropriate. To assess the economic and social values of the Project and to determine the accountable returns from an investment in it has involved

research into matters of practical importance not often taken into account in irrigation policy in the past.

The Importance of the Prairies to Canada's Economy

7. The commercial attributes of agricultural expansion in Western Canada have been defined with great lucidity by Professor Fowke in his historical review of the economic development of the Prairie Provinces, prepared for the Commission. (Part II, Chapter 3)

Western agriculture expansion, (he wrote) led to eastern urbanization, to the growth and prosperity of commercial and industrial centres. To equip and service the agricultural frontier there was necessarily a tremendous increase in the manufacturing, merchandising and transportation facilities of the country. The frontier farmer is typically a trader. He sells much and buys more, financing the difference by the accumulation of debt. Westward over the continental trade routes, over rivers and increasingly over railways, there moved the manufactured products of eastern cities. Eastward in return there moved the products of the expanding agricultural areas, cereals, livestock and and livestock products. The national income and the national revenues multiplied, partly as a direct result of increased agricultural production but more particularly because of the commercial and industrial employments which followed inevitably in the wake of agricultural immigration and settlement.

The typical economic interpretation of Canadian development, according to Fowke, has consistently underestimated the commercial importance of agricultural immigration and settlement processes. The Canadian frontiersman has typically been a substantial buyer and seller of goods and has consequently been of direct practical interest to commercial and industrial groups. The points

to be noted, he wrote, "are (1) that the economic purposes of the national policy were essentially commercial, and (2) that western agricultural development came to represent a substantial part of the objectives of the national policy, largely because of the recognized commercial attributes of large-scale immigration and settlement".

8. The commercial frontier has followed the agricultural frontier in the past. The future development of Canada requires that agricultural progress shall be maintained. Farm expansion requires additions to the labour force of the nation and the provision of an entire range of capital equipment. It requires the outfitting of new farm units with buildings, machinery, household furnishings, and a wide variety of incidental equipment. It calls for expansion in transportation facilities and market centres. It invokes a demand for the products of Canadian manufacturing industry. Agriculture has been a key element in Canadian prosperity. The gains from it should be consolidated. It is within this context that the question of the economic value of the South Saskatchewan River Project and the wider issue of the beneficial use of the resources of fertile but arid land and the supply of water available in that river, must be judged.

9. Agriculture in the Prairie Provinces has been of high importance to the economic life of Canada and will continue to be so. During the past decade these provinces have produced each year almost half the products sold off the farms of Canada, though only one in five Canadians lives on the Prairies. Just as the prosperity of Canada is linked intimately with that of the West, the economic troubles of the Prairie region have fateful consequences for the entire nation.

The setback suffered by the western wheat economy in the 1930's through drought and depressed prices was a disaster in which all Canada shared. The expenditures for relief works and other relief made by all governments in Canada in 1930-40 amounted to \$1,291,000,000, of which nearly half was furnished by the Federal Government. Saskatchewan alone required nearly one-quarter of the entire expenditures in Canada in the 1930's for relief and similar types of assistance. Financial assistance to farmers in the Province, the Saskatchewan government informed the Commission, has amounted to \$340,100,000 since 1907, of which \$153,600,000 was furnished by the Federal Government. An additional amount of \$125,000,000 arose from debt adjustment and tax cancellations. Most of this relief total was provided in 1929-39.

10. The magnitude of the drought disaster of the 1930's, which left so deep an imprint upon the Prairie Provinces, cannot be measured in financial statistics, such as the relief figures or the decline in physical production and in economic values. The average cash income from the sale of farm products in the Prairie Provinces, which was \$1,053,400,000 in 1946-50, had been only \$204,800,000 in 1930-34. In the 1920's this income had been four times greater than it was in the depth of the depression. The repercussions of this decline were felt throughout the Canadian economy. But to the farmers directly involved, the drought not only cut off their income but dissipated their capital. Buildings and equipment fell into disrepair and farm debt rose. Public services became disorganized and distress in some districts, as Fowke noted, "approached dangerously close to famine proportions".

The Value of Irrigation

11. The Commission's terms of reference in no way involved a judgment upon the benefits of irrigation as such. The Commission assumed, to start with, that the benefits of irrigation are tangible and obvious in a region of relatively light rainfall, such as the central drainage area of the South Saskatchewan River. Water is the foremost natural resource of a community existing in a land of limited rainfall. This is an enduring fact that has been impressed upon the Canadian mind by the national emergency created by drought in Western Canada during the exceptionally dry years from 1930 to 1937.

12. Measures that will strengthen the rural economy are bound to be reflected in the well-being of the country as a whole. Irrigation is one such measure. In the region between Lethbridge and Medicine Hat in Alberta, the contrast between the irrigated and the non-irrigated lands is startling. On the one hand there are well kept houses amid the luxuriant growth of gardens, fields and trees in the irrigated districts and, on the other, shabby farm buildings in bleak and desolate surroundings in the dry areas. Dry farming does not encourage or sustain the community development that is visible where the land is watered by irrigation. The skilful dry land farmer, if he operates upon a scale large enough to assure his financial success, frequently is intent upon making a stake and retiring to some more congenial locality. Dry farming is subject to fluctuations of climate and prices so that its condition is aptly known as either a feast or a

famine. Dry farming possesses inherent advantages of its own, but they are not the concern of this Report.

13. The South Saskatchewan River Development area is conspicuously one that suffers from low natural precipitation. Its need for irrigation can be established if reference is made to the main agronomic features of the Project area, without considering the cost and other factors which the Commission was required to take into account. The annual precipitation is less than 15 inches, and the effective precipitation is less than that because of the loss of spring run-off. A high rate of evaporation further reduces the effective precipitation. The Project area clearly would benefit from irrigation. The growing season is short, but the area has the advantage of long summer days. It can produce a variety of crops. Soil is second in importance only to water. The records indicate that the soils of the area may be classified as 25 per cent "very good for irrigation", 53 per cent "good", and 22 per cent "fair". Sub-soil conditions indicate that seepage and the distance to the water table may be controlled. Given good supervising staff, the Project area is suitable for irrigation purposes.

14. For administrative purposes, the legal "duty of water" is fixed in Alberta at 1.5 feet. This is expressed as 1.5 acre-feet for the irrigation season May 1 to September 30. The duty of water is the quantity of water required to produce the optimum growth of crops. It will vary from season to season. A duty of 1.5 acre-feet for the crops on the South Saskatchewan Project would be a safe estimate. To this must be added another 1.5 feet for transmission and other losses,

making a general duty of 3 acre-feet. The Project would require, therefore, about 1,350,000 acre-feet annually when the irrigated area reaches 450,000 acres. The reservoir with a dam at the Third Meridian could contain upwards of 8,000,000 acre-feet of which 2,650,000 acre-feet of water storage would be available for irrigation between full supply levels of the reservoir and canals. Insofar as present plans for irrigation upstream are concerned, there would be ample water left for the South Saskatchewan irrigation development.

15. For many years to come, it is likely that the system of agriculture on the South Saskatchewan Project would be of a live-stock character. That means that forage crops would be grown and, supplemented with grains from nearby dry areas, fed to livestock on the farm. The crop problems of the Project would, however, best be determined after some experience on the Project itself. There are certain specialized crops which, after experience has been gained, might become very important in the crop program. It is certain, however, that forage crops, particularly alfalfa, could be grown profitably on the Project, if wise methods of irrigation were followed. Alfalfa is not only a good yielder under irrigation, but it is a valuable soil improver, and has great value in the feeding of livestock when combined with some of the grains that may be raised on the non-irrigated sections of the plains. Wheat itself is not an ideal crop for irrigation as early attempts in Alberta have very definitely shown. Lands quickly become weedy. Soil fertility is depleted for want of crop rotation. The growing of wheat under irrigation cannot compete with dry farming in areas having reasonably adequate rainfall.

Another consideration is that the Project is not one continuous body of land. An irrigation project is always handled better if it is in one continuous area. Of course, this Project, if constructed, can be so built and so managed that each somewhat separate body of land would be a unit, and an independent unit, of the whole.

16. The need for irrigation in the South Saskatchewan Development area and the desirability of launching an irrigation scheme there, cannot be considered in isolation. The yardstick of cost must be applied to such a scheme and, in addition, the question of the most beneficial use of the resources available for development of the river basin should be settled. There can be no dissent from the general principle that, in the open plains region of Canada, all the water that can be stored economically should be put to beneficial use. But within that context, the demands made upon the great natural resource represented in the South Saskatchewan River Basin should be determined by the assurance that present and future benefits are commensurate with the cost.

The Problem of Palliser's Triangle

17. For the profitable and desirable utilization of land and water resources in a relatively arid drainage basin in the heart of the Prairie Provinces, the chief means must be irrigation. The driest part of the prairies is known as Palliser's Triangle, after Captain John Palliser of the Royal Engineers. John Palliser explored the Canadian prairie region between 1857 and 1860 under the auspices of the British Government. The central desert

region of the United States, he reported, extends a short way into British territory, "forming a triangle". The Canadian Government sent expeditions to the prairie region in 1857 and 1858 under Professor H. Y. Hind, the geologist and naturalist of Trinity College, Toronto. Hind's account agreed in general with Palliser's. An analysis of Palliser's and Hind's accounts of climate and agricultural possibilities in the South Saskatchewan drainage area is found later in this Report in the section setting out the historical background of economic development in the area. (Part II, Chapter 3)

18. Palliser's Triangle is a generalized concept. It is only roughly triangular in shape and the conditions encountered therein are far from uniform. Its centre consists of a hard core of drought area, or inner triangle, that is genuinely arid. This inner triangle has its vertical axis on the Alberta-Saskatchewan boundary with its base on the United States border. In extent, this hard core of drought area is not more than half the triangle of Palliser. It too possesses gradations of aridity. It comprises the last area to be settled in the southern prairies and the first districts to be abandoned. It includes the successful irrigated areas of Alberta, but not those areas where irrigation has been attempted without success. It includes the Special Areas of south central and southeastern Alberta, and all of Saskatchewan west of a line running through Moose Jaw and the big bend of the South Saskatchewan River. It includes the districts in which the problems of drought have been most severe, and the costs of drought relief and of human suffering, due to the failure of rain, have been highest. It comprises the

drainage basin of the South Saskatchewan River east of a line roughly from Lethbridge to Drumheller, extending into Saskatchewan to the eastern edge of the Missouri Coteau. The Grand Coteau de Missouri, to use the earlier name, is generally called the third prairie steppe. "From the character of its soil and the aridity of its climate," wrote Hind, "the Grand Coteau is permanently sterile and unfit for the abode of civilized man". This is the "dust bowl" of western Canada, the locality which endured the worst ravages of the Great Drought of the 1930's. It comprises at least 15,000,000 acres. It includes districts in which settlement has failed. The reason for attempting irrigation in such an area would be, according to W. L. Jacobson, "because that is the only way in which that area can be used."

19. The most beneficial use to which the South Saskatchewan River could be put would be the reclamation of the arid heart of Palliser's Triangle. Yet such an objective has not been incorporated into public policy. The first irrigation projects in Western Canada were launched on the southwestern fringe of Palliser's Triangle, an area which is frequently deficient in moisture and is speculatively farmed on the prospects of the season's rainfall with varying results, but is generally suitable for dry land farming. These projects were established on the fringe, rather than in the heart of the Triangle, without regard to gradations of climate that indicate that the land most in need of irrigation lies to the east. The fact that emerges clearly in an account of irrigation development in Western Canada found elsewhere in this Report (Part II, Chapter 4), is that the problem of irrigating the core of aridity

in Palliser's Triangle has not been considered directly. Significantly, the limits of irrigable area in Alberta have moved steadily eastward towards this core during the last half century.

20. The origin of irrigation upon the fringes of the dry region, rather than in its heart, is one of the accidents of the economic history of Western Canada. The fringe areas of the dry triangle were settled for the most part before the homesteaders entered the dry region west of Moose Jaw. The inner triangle waited for settlers until a combination of demand for wheat as a result of World War I and the pre-emption policy in 1909, which allowed 320 acres to a homesteader rather than 160, made it more attractive for settlement. The fringe areas are sub-humid and semi-arid, but not truly arid. Even today, in view of the lack of climatological data tested by observations over a long period of time, it is not possible to define precisely the areas within the triangle which are in greatest need of irrigation. Such information is basic to a full understanding of the problems of dry farming and irrigation alike in Western Canada. It is fundamental to policy designed to deal with the problems of drought in Saskatchewan and Alberta.

21. While the relative need for moisture in the fringe areas encouraged the development of irrigation in them, the main determinant of the first irrigation projects in Alberta was the relative ease of diverting streams within the foothills region. Decisions were made, not on the basis of need to irrigate so much as of ease in construction of dams and diversion canals. As a result some of the earliest irrigation projects failed. They reverted to dry farming agriculture, in which they succeeded and in which they

should remain, in line with a wise, national agricultural policy. Not being truly arid, the fringe areas of Palliser's Triangle are excellent dry farming areas, and in them the steady technological advance of dry farming has produced its greatest benefits. Where basic conditions have favoured dry farming, efforts to substitute irrigation farming have failed in more or less degree.

22. Experience gained in the development of irrigation in the West suggests the wisdom of proceeding with caution. An example is found in the Western Irrigation District, just east of Calgary. It was launched by the Canadian Pacific Railway in the expectation that a sufficient return would be obtained to show a profit in land values and, at least, to repay capital costs. The economic analysis supporting these expectations was incorrect. Originally the scope of the district was 219,000 acres, of which only 50,000 remain today. The remainder is tilled successfully by dry farming methods. The abandonment of so much of the original irrigable area represents a heavy capital loss. The C.P.R., in due course, wrote off substantial capital and operating losses and surrendered the irrigation works to the farmers. There are other examples of failure and loss in irrigation in Western Canada which indicate that irrigation must justify itself in competition with dry farming. "There must be a real human need for a project of this magnitude to succeed", as one irrigator said.

23. The conclusions to be drawn are:

(1) It is a fundamental error to attempt at heavy cost to persuade farmers in a region suitable for dry farming to turn to irrigation, and

(2) It is illusory to believe that farmers in an irrigation district can or will contribute

towards the costs of development anything more than a relatively modest sum, certainly no more than can be related to the increased productivity of his land.

24. In Alberta, the increased productivity arising from irrigation seems to have been consistently exaggerated. This is doubtless due to the failure to realize that economic progress in irrigation farming is limited by the growth of markets for the products of irrigated farms. This is an error in timing, an error that leaves out of account the slowness of market growth which, in the nature of things, is limited by the pace of population growth in Western Canada.

25. One of the major criticisms to be made of the South Saskatchewan River Project is that, in relation to the area of Western Canada that is truly devoid of moisture, it is a "fringe" project, with borderline climatic conditions, from the point of view of need for irrigation. Its irrigable area, lying along the river below Outlook, extends on both sides of the valley to the vicinity of Saskatoon. It extends to the edges of open prairie northward into the bordering area of the park country where the evidence of moisture is the prevalence of brush that consists mostly of small poplars. The Project would lie in a region in which the farmer would enjoy a choice of irrigating or not irrigating, as he judged the weather probabilities. Choice of one way of life and not another must depend upon personal preference. It is not a function of government in Canada to determine such preferences. Green vegetation is not necessarily a sign of a high standard of living; nor does dry farming necessarily mean a low standard. The irrigation farmer and the wheat farmer each has his place in our

economy. Within the framework of these circumstances, the limits of prudence in investing public funds to irrigate the South Saskatchewan Development area must somehow be fixed.

26. One feature of the South Saskatchewan Project is that the area is already developed for agricultural purposes. It is an area of dry farming devoted mainly to cereal production. It suffered its measure of distress during the period of great drought in the 1930's. It contains excellent dry farming districts and, as well marginal areas. Its farmers cannot afford to neglect any opportunities for the conservation of water. But it is by no means an abandoned area. The development of irrigation in the Project area, therefore, cannot be considered wholly as the reclamation of lands which, without irrigation, would not be utilized.

Resources of the Saskatchewan Basin

27. The Saskatchewan River is an important natural resource of three Provinces. The political boundaries in no way coincide with the natural geographic regions. The upper regions of the Basin on the eastern slopes of the Rocky Mountains, and the western section of high, short-grass plains, lie in Alberta. That part of the Basin that includes the second prairie steppe lies in Saskatchewan. The delta region where the drainage area is narrow, lies astride the Manitoba-Saskatchewan boundary.

28. The primary developments in the Basin in Alberta are forest conservation, hydro-electric power generation and water storage, with all the major irrigation projects

located in the high plains area. Several sites for storage development exist, in addition to the reservoirs on the upper Bow River. In regard to irrigation, when existing projects are fully developed the flow of all the tributaries of the Basin south of the Bow River will be completely utilized except for winter and flood flows. Only the Red Deer and the North Saskatchewan Rivers remain for large irrigation developments, and the latter is unlikely to be developed within its own drainage area because the climate appears satisfactory for dry farming. In the central prairie region, the stream flows through deep valleys. Very large amounts of storage are possible, if the expense of constructing high dams is justified. Below this area, locations exist for hydro-electric developments but they appear generally to be marginal.

29. An examination of existing and possible future uses of the flow of the South Saskatchewan River indicates that an apportionment of the water in terms of its most beneficial use should be made. But such an apportionment can be made only in the light of a full examination of data, not all of which are available. The consumptive use of water for irrigation on the higher prairie steppes, for instance, will eliminate its use for generating power lower down. Increased storage capacity in the mountain and foothills region will assist in developing irrigation where it is needed lower down. The development of power sites in the lower reaches will subtract from the possibilities of further irrigation development higher up.

Deficiencies in Basic Data

30. The prime need for the basic data of the engineer, the agronomist, the hydrologist and the economist as a guide to future irrigation development in Western Canada is demonstrated by the mistakes of the past. Many errors and some of the losses could have been avoided if the technical knowledge of today had been available yesterday. Yet for tomorrow, much more research must be conducted in the region of true aridity in southwestern Saskatchewan and southeastern Alberta, if it is to be fully reclaimed and exploited in the national interest.

31. The Commission desires to point out that serious deficiencies exist in the fund of basic data available for the integrated development of the South Saskatchewan River Basin. Sound policies for the conservation and use of the water resources of the Saskatchewan River Basin and sound planning for their orderly development must be predicated upon two fundamental premises. The first is knowledge of the water resources in different regions. The second is the extent to which these water resources have been developed and utilized up to the present.

32. Western Canada has passed the stage where the natural, unregulated stream flows are sufficient for developmental purposes. Now the further development of large areas depends in considerable part on the extent to which water may be conserved by storage. More important than the complete use of water resources, is their equitable and efficient use. The water problems within any large basin differ from region to region and no common plan for the control and use of water in different regions will suffice. No

recommendations for an over-all water plan are possible without data on uses of water, precipitation, temperature, humidity, wind, evaporation, stream flow, quality of water, groundwater conditions, soil surveys, and topographical surveys. Without study of all phases of the many problems involved, recommendations could be unsound and might lead to economic waste. Unfortunately, fundamental data, the consideration of which is a prerequisite to an enlightened program of water conservation, still are lacking in greater or less degree in the three Prairie Provinces.

Legal and Constitutional Complications

33. The second part of the Commission's reference, namely, whether the Project represents the most profitable and desirable use which can be made of the physical resources involved, obviously requires an examination of the inter-relationship of various developments along the river. The interests of communities both urban and agricultural along the river, which exist today and which may develop in the future, are intimately affected by plans to control and develop the flow. In considering the integrated development of the river, the Commission has come to the conclusion that appropriate administrative machinery should be provided and entrusted with, among other things, the responsibility for an inventory of the basic data of the resources of the drainage basin, to make possible an over-all program of managed development.

34. The South Saskatchewan River system is the main water course of the semi-arid regions of southern Saskatchewan and

Alberta. The chief hope of water conservation on a large scale in these regions must rest upon this great river, whose annual discharge is seven or eight million acre-feet of water. At the same time, the beneficial use of the entire flow of the South Saskatchewan River would not likely suffice for the arid, inner triangle. A good deal of dry country, that fully merits the best efforts of the water conservationist, lies beyond the reach of the most ingenious plans for the exploitation of the South Saskatchewan. The small projects devised or intended by the P.F.R.A. would still represent the only hope of many districts. The full utilization of the South Saskatchewan River cannot transform the entire arid area of the western plains into a drought-free and depression-proof region. Yet its utilization should be undertaken as a national obligation. Construction necessary to that end should be recognized as works to the general advantage of the people of Canada.

35. That the time has come to consider the development of the South Saskatchewan River in terms of national benefit rather than of isolated, local developments is clearly recognized by many persons who are informed on the problems of water conservation in Western Canada. Premier Campbell of Manitoba, in a letter to the Commission, referred to the effects of upstream developments upon the potential capacity of hydro-electric power sites in Manitoba, adding: "It would appear therefore that your Commission should give consideration at this time as to what responsibility the Government of Canada should accept for the integrated development of the

entire watershed." The Province of Alberta in its submission, made this observation:

Because the conservation and best use of inter-provincial streams in the Saskatchewan River drainage basin can only be attained through the regulation of the flow of the streams by storage, and because the natural and artificial storage sites are in the mountain and foothill regions of the drainage basin, it is not possible to administer the water resources of this basin in the best interests of the respective provinces except through a single administrative authority. In other words, these interprovincial streams cannot be administered in the best interests of the most beneficial use of water by the respective provinces separately.

Failure to take in hand plans for the full conservation of the water of the South Saskatchewan River for irrigation and allied purposes will invite criticism from which there would be no escape in a time of failure of rainfall in the future. The Commission had to consider, therefore, where the responsibility lies for the full utilization of the South Saskatchewan River on the basis of integrated, basin-wide development.

36. The head waters of the South Saskatchewan River are in Montana and southern Alberta and it flows into Saskatchewan where, north of Saskatoon, it joins with the North Saskatchewan to form the Saskatchewan River which flows into Lake Winnipeg, and from there by the Nelson River into Hudson Bay. Prior to 1930, the Crown in the right of Canada exercised sole legislative and administrative control over this and other resources in the three Prairie Provinces. In that year the administration of these resources, formerly held by the Crown in the right of Canada, was transferred to the Crown in the right of the provinces concerned. This transfer resulted in a single administration being replaced by a divided

administration. Of this situation, D. M. Stephens, formerly Deputy Minister of Mines and Natural Resources of Manitoba, has said: "I think it is safe to say that the co-ordinated development of the water and related resources of the Saskatchewan River watershed represents one of the most important and one of the most complex problems in the field of resources management with which Canada is faced today. There are two national governments, three provincial governments, one state government and literally hundreds of municipal governments, each having its own general or special interest in the Saskatchewan River. There are at least six separate and distinct geographic regions each with its separate and distinct problem and possibilities relating to the control and use of water, not all of which are by any means compatible with all others."

37. The Commission is advised that development in the manner desired of an interprovincial stream like the South Saskatchewan River involves the solution of complex legal problems and problems of jurisdiction about which at present there is considerable uncertainty. While the Commission's reference does not include the making of suggestions to solve these problems, the Commission desires to point out that legal and constitutional difficulties exist. These problems are not only legislative difficulties arising from divided jurisdiction. As the Alberta submission argued, it would be difficult to administer the water resources of the Basin properly without a single administrative authority in charge.

38. The transfer of the natural resources to the Prairie Provinces in 1930 represented the fulfilment of national policy and the

achievement of Western Canadian aspirations in that regard. Yet that event left a vacuum in policy with respect to interprovincial rivers. The transfer meant the end of the Federal Reclamation Service, with a long and honourable record of water engineering, and the beginning of water conservation policy on a provincial scale. It opened the door to conflict among the provinces over a river such as the Saskatchewan, in which each province's interest may differ but in which development in one province may be of vital concern to others. The Commission feels that the conflict that is largely incipient today could harden and endanger the harmony in provincial relationships that is essential to the future economic development of Western Canada.

39. Within five years from the transfer of administrative control of the natural resources to the Prairie Provinces, the Federal Government felt that some special action was required for the relief of the people in those provinces. Parliament, therefore, enacted the Prairie Farm Rehabilitation Act which created an agency within the Federal Department of Agriculture to implement policies which involved, among other things, the development and promotion of water supply and land utilization. The P.F.R.A. has enjoyed conspicuous success in its water conservation programs.

40. The Province of Saskatchewan, formed in 1905 and having assumed administrative responsibility for its water resources in 1930, has recently organized a Conservation and Development Branch which has organized 45 water users associations, irrigated 50,000 acres, constructed 145 miles of ditch, developed 475,000 acres of dry land projects

and improved the drainage in 1,000,000 acres. The Federal Government's efforts to assist Saskatchewan in dealing with the basic problem of climatic fluctuation by the beneficial use of water and improved land use, under the Prairie Farm Rehabilitation Act, have resulted in irrigating 125,000 acres in 168 projects in the Province, and a further 10,000 acres were being developed in 1952. In total, the P.F.R.A. work in Saskatchewan is represented in 31,361 small projects and 168 community projects. Those associated with this work regard the present stage of development of small water projects in Saskatchewan as perhaps half completed. There is considerable work of this kind still to be done. It is desirable to avoid duplication of effort. There is a shortage of engineers and other trained technical experts. The conditions of co-operation in this field are difficult. Responsibility for land use is exclusively provincial, yet the consequences of failure to achieve the most beneficial use of land and water throughout the arable regions of Canada create many problems of Federal concern.

41. Many agreements have been concluded between the Federal Government on the one hand and each of the four Western Provinces on the other, to carry out recommendations made under the Prairie Farm Rehabilitation Act. In no instance has a question arisen regarding the rights of another province, until the South Saskatchewan River Project.

42. The Prairie Provinces Water Board was established on July 18, 1948. It is apparent that the functions of the Board are advisory. Its members are public servants employed by the various interested govern-

ments. Its proposals become effective only after each of the governments who are parties to the agreement implement the recommendations. Each government therefore has a veto power for every agreement. The members are Canada, Manitoba, Saskatchewan and Alberta. An application by the Government of Saskatchewan concerning an allocation of water for the South Saskatchewan Project is currently in the "Reservation Class" of the Board, that is, it has not been decided.

43. There is disagreement on the Prairie Provinces Water Board and among the governments who are members of it as to the function of the Board. The extent of the disagreement was called to the attention of the Commission by the Province of Alberta, in its written submission. There is no unanimity on the question whether or not the cost of a given project should be the concern of the Board. There is equally no unanimity whether or not economic factors involved in a given project should be considered by the Board. Decisions of the Prairie Provinces Water Board have been made, in line with the authority of the Board, on the basis of water supply. The Board has considered specific projects without reference to the general requirements for water throughout the Prairies as a whole, or to the interests of the country as a whole.

44. The terms of reference of the present Commission, which was established on August 24, 1951, involve considerations which have not been raised previously in connection with water conservation policy in Western Canada; that is, whether benefits are commensurate with costs and whether a specific project represents the most profitable and

desirable use which can be made of the resources in question in the interests of the Canadian people as a whole.

45. Any works erected on the South Saskatchewan River for irrigation, storage or power purposes within its jurisdiction by one province may affect the supply of water in the other two provinces if it interferes with the natural flow of the stream. The exercise of exclusive jurisdiction by any province through which the river flows might, therefore, interfere with the property rights in the river system of the other provinces. The consequent necessity for co-ordinated use of the waters was recognized by the creation of the Prairie Provinces Water Board and that necessity is now asserted by the Provinces of Alberta and Manitoba. It follows that a major project such as the proposed South Saskatchewan River Development must have regard to the rights in the river system of interested parties in Alberta and Manitoba.

46. The main considerations which seem appropriate to the development of an inter-provincial river such as the Saskatchewan are:

- (a) The fact that the river system is a single stream upon which property rights in each province should be respected.
- (b) The duty of each provincial authority to exercise its rights reasonably and in a manner calculated to conserve the common supply of water.
- (c) The rights already acquired by prior appropriation of waters of the river system in each of the provinces.
- (d) The future development of the river on the basis of its beneficial use to the people of Canada.

- (e) The rights of the Federal Government commensurate with its financial participation in the full development of the river system.
- (f) The administrative problems involved in assuring to the people of Canada the best utilization of the resources of the river Basin.

47. The principles upon which development of an interprovincial river should be based, may be defined briefly. Development programs should be planned in accordance with the beneficial use of such a river in the interests of the people of the Prairie Provinces and of Canada. They should take account of prior allocations of water so that existing uses of the river may be protected. Between provinces there should be equitable apportionment of the flow of the river. If a river system is to be developed on the principle of its beneficial use to the people of Canada, an equitable apportionment does not mean an "equal division" of the waters, but an apportionment having due regard to the best use from a national standpoint of the resources of the drainage basin.

The South Saskatchewan River Project

48. The origins of the South Saskatchewan Project may be found in the somewhat vague and often conflicting concepts which have persisted in kindling the imagination of men who have stood on the dry benches of the South Saskatchewan River valley and have noted the juxtaposition of wide, dry lands and an abundant seasonal flow in the stream below. Such concepts are not subject to strict tests of feasibility and desirability. The first proposal to harness the

river was made by Professor Hind nearly a century ago. His interest was in transportation rather than agricultural production. Hind reported to the Legislative Assembly of Canada in 1859 that a dam built at the elbow of the South Saskatchewan high enough to spill the river flow into the Qu'Appelle River valley, would provide a steamboat route for settlers from Fort Garry to the foothills of the Rocky Mountains. William Pearce, the explorer and early land surveyor, first suggested a diversion of the Red Deer River in order to carry water across Alberta and into Central Saskatchewan for livestock and other purposes. Surveys and estimates of the William Pearce Scheme were made in 1920, but they showed the scheme to be expensive.

49. Studies related to the utilization of the main stem of the South Saskatchewan River were begun by the P.F.R.A. in 1943. The proposal to construct a dam across the river in the vicinity of the elbow was revived by the P.F.R.A. in 1947, and since that time intensive research into the Project has been carried on. The main motive in the preliminary investigation into the South Saskatchewan River Project was to find ways to irrigate on a large scale in Saskatchewan as well as in Alberta. Pursuing the hope of finding alternative ways of irrigating at least part of the land in Saskatchewan associated with the Pearce scheme, the P.F.R.A. began investigations into the possibilities of a diversion on the South Saskatchewan River. The first surveys were directed at the reach of the river in the vicinity of the Cabri Ferry, above the elbow, with the intention of utilizing the White Bear depression. This would bring land

between Elrose and Saskatoon and east of Rosetown within reach of the river. But further surveys indicated that the lands suitable for irrigation were not as extensive as first believed, that suitable lands to the east and south of the river could not be reached, and that valuable lands in the neighbourhood of Lacadena would be submerged. Moreover, foundation conditions for a large structure, though hardly satisfactory anywhere along this section of the river, seemed particularly poor at the Cabri site. Investigations, therefore, were concentrated lower down the river, and since 1947 they have been confined to the site at the mouth of Coteau Creek near Outlook.

50. A description of the South Saskatchewan River Project in considerable detail will be found elsewhere in this Report. (Part II, Chapter 6.) For the purpose of considering the general features, a brief account is given here. The Project is designed to provide for the irrigation of 455,000 acres of land in Central Saskatchewan. It would also provide four secondary benefits:

- (a) a source of hydro-electric power for a province-wide transmission system;
- (b) a source of rural and urban water supply;
- (c) stream and flood control; and
- (d) recreation facilities.

51. The essential works required are:

(1) The creation of a reservoir by the construction of a dam on the South Saskatchewan River, 18 miles upstream from the town of Outlook. A second major dam is required on the upper Qu'Appelle River Valley in the vicinity of the Third Meridian. The main dam would require an extension across the mouth of Coteau Creek. In addition,

it is proposed to provide a railway crossing on the Moose Jaw-Outlook line, involving a substantial earth fill.

(2) The construction of the irrigation canal distribution system, with pumping facilities where required.

(3) The construction of a hydro-electric powerhouse.

52. The four large earth structures—the Main Dam, the Coteau Creek Dam, the Third Meridian Dam and the railway crossing—would require a total of 57,500,000 cubic yards of material, most of which can be obtained in the vicinity. The dam would be 205 feet high with a crest length of more than 8,000 feet from bank to bank. It would impound about 8,000,000 acre-feet of water, of which 2,650,000 acre-feet would be live, or useful, storage. The reservoir would extend 140 miles upstream on the South Saskatchewan River and 30 miles down the Qu'Appelle River Valley to the Third Meridian. The reservoir would have a surface area of 116,000 acres and a shore line of almost 500 miles. It would inundate about 70,000 acres of land of which 11 per cent is under cultivation.

53. The irrigable lands are located on both sides of the South Saskatchewan River in the section extending from Elbow to the vicinity of Saskatoon. In addition, an irrigable area of about 24,000 acres exists along the valley of the Qu'Appelle River.

54. The Project would involve the relocation or abandonment of the Canadian National Railways line from Central Butte to Dunblane as the river crossing at Elbow would be flooded out. A portion of the Canadian Pacific Railway line from Moose Jaw to Outlook would have to be raised.

55. At least six years would be required for construction of the main works, after preliminary steps were taken. In the early stages of construction, considerable latitude would be possible in the amount of work undertaken in one season, but definite minimums of work would have to be completed at critical stages, such as the closure operations. Work on the irrigation system could be planned to start three or four years after commencement of construction of the reservoir.

56. No water would be available for irrigation until the dam was practically completed. The construction of canals could be timed to suit the demand for irrigated land, or other conditions. A reasonable program would be first to irrigate all lands that could be reached by gravity. These lands could be irrigated in the season when the dam was completed. In the main area (excluding the Qu'Appelle River Valley) the irrigable lands of 454,950 acres include, according to the P.F.R.A., the following:

	<i>Acres</i>
By gravity	179,800
Pump lift 15 ft.	45,750
30 ft.	70,400
60 ft.	80,400
120 ft.	78,600
	<hr/>
	454,950

57. The demand for power for pumping water would be a first claim upon the output of the power plant. This demand would increase as the Project developed. Twelve large pumping stations would be required. Upon full development of the irrigation system, pumping would require 50,000,000 kilowatt hours of energy, with a maximum demand approaching 40,000 kilowatts.

The Estimate of Cost

58. The preparation of an estimate of cost of the South Saskatchewan River Project was regarded as a fundamental step by the Commission, in dealing with its terms of reference which required it to inquire whether the economic and social returns to the Canadian people on an investment in the Project would be commensurate with the cost. Several estimates of cost had been prepared. They had been based upon the engineering studies made by the Prairie Farm Rehabilitation branch of the Department of Agriculture. These studies were supplied to the Commission in a single large volume, the General Engineering Report. This report represents the expenditure of many hundreds of thousands of dollars of investigatory work carried out over a period of years, and is still subject to alteration and enlargement. The Commission did not review the basic engineering studies of the P.F.R.A., except to confer with the senior engineering consultants of the P.F.R.A., namely, Major General H. B. Ferguson, Washington, D.C., Dr. Arthur Casagrande, Boston, Mass., and L. F. Harza, Chicago, Ill., on certain aspects of the Project wherein the engineering difficulties were obvious and which would influence the cost. This conference was held in Washington, D.C., in April, 1952, and as a result the Commission decided to obtain an estimate taking into account the views of the senior consultants and, as far as possible, the experience of firms engaged upon comparable construction projects.

59. In preparing an estimate of cost, the Commission relied upon the General Engineering Report on the Project supplied by the

P.F.R.A. The estimate was prepared for the Commission by Mannix Ltd. of Calgary, Alberta, which availed itself in turn of the experience and professional knowledge of a number of United States firms which have been engaged directly for a number of years on large engineering projects comparable in scale, if not in precise detail, to the South Saskatchewan Project. Notable among these firms were Morrison-Knudsen Co. Inc., Boise, Idaho, a firm which is one of the prime contractors on the \$290,000,000 Garrison Dam project on the Missouri River, which is comparable to the proposed Coteau Creek Dam, and International Engineering Co. Inc., San Francisco, California. The Commission feels confident that it obtained the best study of cost of the project that can be made on the basis of data available.

60. The following General Summary of Cost Estimate is from the report submitted by Mannix Ltd. Details of quantities and other data will be found in Part II, Chapter 7, of this Report.

Diversion, care of river and unwatering working places	\$ 2,821,000
Main dam	19,971,230
Conduits and intake	25,179,005
Powerhouse area	2,054,695
Powerhouse and switchyard	16,354,350
Spillway	10,087,400
Coteau Creek dam	1,630,335
Third Meridian dam	4,721,650
Elbow Railway crossing	5,242,255
Railway relocation	2,857,690
Cement	8,368,665
Operators' village	300,000
Road relocation and bridges	3,000,000
Miscellaneous service and general plant operation	5,157,900
Land damage and acquisition	600,000

Contractors' general expense	12,301,400
Allowance for contractors' contingencies ..	4,000,000
Escalation of wages and materials	10,000,000
Engineering	8,000,000
Interest during construction	6,125,000
Contractors' general overhead and profit	15,000,000
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	\$163,772,575
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61. This estimate does not include two important items:

(1) Irrigation structures, outlets and distribution system.

(2) Contingencies for any changes in design or over-run in quantities.

62. To furnish a complete figure, the cost of the irrigation system should be included, but it was omitted because the field surveys, plans and specifications were not sufficiently advanced. Preliminary and general estimates of the cost of the irrigation system had been made, however, by the P.F.R.A. The Commission decided that, in arriving at an estimate of the cost of the entire Project, allowance should be made for not less than \$45,000,000 for the irrigation system. An additional cost would be 12 pumping stations, requiring an allowance of \$30,000,000. A further cost would be land acquisition. This item would amount to \$9,100,000. The approximate over-all cost would be:

Main works and reservoir	\$139,800,000
Power Plant	24,000,000
Irrigation system	45,000,000
Pumping stations	30,000,000
Land acquisition	9,100,000
	<hr/>
	\$247,900,000
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63. In summary, the estimate of P.F.R.A. made originally in 1947 and revised in 1951 in the light of changes in design and data, was:

Dam and reservoir	\$ 66,460,000
Irrigation system	25,100,000
Powerhouse	13,800,000
	<hr/>
	\$105,360,000
	<hr/>

64. Several of the major changes which have been made by the P.F.R.A. and their consultants since the original estimates were made, and which have materially increased the cost, were:

A. It was decided, at the meeting of senior consultants on the Project arranged by the Commission in Washington, D.C., in April, 1952, to recommend a steel lining of 1½ inches thickness in the three conduits between the intake structure and the powerhouse, a length of 2,750 feet. This liner would require 33,000,000 pounds of steel plate, at an estimated direct cost installed of \$11,200,000.

B. It was also decided to use Kalicrete concrete rather than ordinary Portland cement, on which the P.F.R.A. estimate was based. This would increase the direct cost by approximately \$1,273,000.

C. The design of the left embankment trim was altered from a structure requiring 2,113,000 cubic yards of fill to 6,316,000 cubic yards of excavation.

D. The layout of the conduits and spillway outlet channel was revised and this increased the quantities required.

65. Some other factors which have increased the cost over previous estimates were:

A. Riprap. The other estimates proposed using field stones from various areas in Central Saskatchewan. Mannix Ltd. did not regard this as practical, nor did they feel that it could be done for \$3.50 per ton (\$4.20 per cu. yd.). Mannix Ltd. based their estimate on bringing rock from the Frank Slide in Alberta, at a direct cost of \$11 per cu. yd. They estimated the total amount of riprap required to be 702,000 cu. yds. Based on this quantity, the estimate would be \$4,774,000 higher than P.F.R.A.'s estimate.

B. Power Plant. The P.F.R.A. estimated the total cost of a power plant to be \$13,800,000. Mannix Ltd. estimated the direct cost to be \$18,409,000, an increase of \$4,609,000. Addition of an appropriate share of the total overhead and other indirect costs to the direct cost of the power plant would allocate \$24,000,000 of the total cost of the Project to the power plant.

C. Mannix Ltd. included allowance for road relocation, general plant operation, contractors' general expense, escalation of wages and materials, engineering, interest on financing during construction, and contractors' overhead and profit, which total \$58,709,300. Information at hand did not indicate what amounts, if any, had been used for these items in the two previous estimates.

66. It should be noted that the plans for the South Saskatchewan River Project are preliminary in nature. They were prepared by the P.F.R.A. for the purpose of determining the scope of the work, and they were not always in agreement with each other. "The intent of the plans", Mannix Ltd. advised the Commission, "was clear and we have reconciled whatever differences we found with the firm intention to build a good job. Where

details were not found on the drawings, we have supplied them, where possible, from our own experience." As no detail on the powerhouse was provided, use was made of a power plant which was designed recently and has the same operating characteristics as the plant proposed for the South Saskatchewan Project, to obtain the necessary list of items and prices for this estimate.

67. The basic wage rates obtained for the estimate are those currently in effect in Saskatchewan and did not include any penalty for working labour beyond 40 hours per week. In regard to wages, the Commission was advised by Mannix Ltd. that they regarded these rates to be low, but found it difficult to estimate the amount by which they should be increased, having no information as to the year in which P.F.R.A. might be authorized to start work on the Project. For the same reason, it was difficult to forecast increases in cost of materials although they would likely be substantial. To provide for escalation in labour and materials, the estimate allowed \$10,000,000 "which might be a realistic guess should the Project be started within two years".

68. The estimate included an estimated contractors' performance bond cost of \$375,000 which is in accordance with present rates, but is not a firm figure since the contract terms which might be contemplated were not known.

69. Mannix Ltd. included an estimate of cost of railway relocation over the Elbow Crossing and main dam in accordance with the owner's project report. A preliminary reconnaissance and estimate on the same basis indicated a possible savings in excess of \$2,000,000 by a crossing over the Third

Meridian Dam instead of at Elbow Crossing. A study of this alternative crossing was recommended.

70. An allowance of \$3,000,000 was made for re-routing highways around the reservoir area.

71. Mannix Ltd. reported: "We are aware that P.F.R.A. has certain arrangements for engineering on this project, and that considerable monies have been spent to date. We have no information concerning these arrangements or expenditures. We have allowed \$8,000,000 for this item, which will include project design and owner's inspection and other costs properly allocable."

72. The estimate included an allowance of \$6,125,000 for interest on financing during construction, based on \$25,000,000 a year for seven years at $3\frac{1}{2}\%$.

73. The estimate contemplated a minimum construction schedule of six years, with a diversion in the fourth or fifth year. These six years would be over and above the estimated six months required to build access roads and set up camps. It was also based on the assumption that all work in the main dam area would be let as one job to one bidder. It was felt that considerable saving would be realized by this procedure in eliminating duplication of supervisory job personnel, contractors' facilities, move-in costs and equipment. A longer construction period with additional cost would be required if the job were let in several separate contracts.

74. In order to furnish a comparison with and a test of estimates of the South Saskatchewan River Project, the Commission obtained a summary of the current estimate (July 1952 prices) of the Garrison Reservoir

Project on the Missouri River. The total was \$289,854,000, but the details concerning present project cost estimates were not available for public release.

Cost of Pumping Water to Land

75. One of the costly features of the South Saskatchewan River Project is the requirement to pump water to three out of five acres in the planned irrigable area of 454,950 acres. Blocks amounting to 179,800 acres could be irrigated by gravity, the remainder requiring pump lifts up to 120 feet. Little irrigation by pumping water has been carried on in Western Canada in the past. Opinions expressed to the Commission by experienced irrigators indicated that pumping costs would be an unwelcome addition to operating expenses. The question would have to be decided, if the Project were proceeded with, whether or not the cost of pumping water should be charged to the Project, rather than to the individual farmer.

76. It was assumed that power, delivered at the pumping stations, would cost \$20 per year per h.p. of maximum demand. At this rate, the cost per acre for power only to pump water to various sections of the irrigable area is shown in the following tabulation:

Pump lift	Cost per acre
15 feet	\$0.78
30 feet	1.57
60 feet	3.13
120 feet	6.27

The weighted average of these costs is \$3.07 per acre of area requiring pumping, or \$2.07 per acre throughout the entire Project. Upon adding the cost per acre for power to the estimated cost for operation and maintenance

of the irrigation works including pumping plants, at say \$2 per acre (based on the average cost for existing projects), a total of around \$4 per acre per year is reached, or double the amount that the irrigation farmer expects to pay in Alberta projects.

77. For purely administrative reasons, it may be suggested, the Saskatchewan authorities entrusted with the management of the South Saskatchewan River Project would likely decide that the simplest procedure would be to charge the cost of pumping water to the Project, that is, to the taxpayers of the Province. One other possibility exists, namely, to obtain the power required to pump water from the Saskatchewan Power Corporation, i.e., at the expense of the power consumers of the Province. The schedule of colonization of the Project, envisaged in preliminary plans, calls for settlement of the areas irrigated by gravity first. The decision would have to be made at the outset whether the costs of pumping would be spread evenly over the entire irrigable area. If the decision were to do that, the farmer whose land requires no pumping would doubtless regard a pumping charge as an imposition upon him. Yet if the land to which water would have to be pumped were expected to bear the pumping charge in proportion to the expense of delivering the water to it, the farmer located on land requiring a pump lift of 120 feet would face a charge of more than \$6 an acre. This would make his annual maintenance and operating costs around \$8 an acre. Such a charge is far more than a farmer in such circumstances could pay.

78. It should be pointed out that the degree to which pumping of water would be required to bring the South Saskatchewan

River Project to full development is excessive in relation to existing irrigation developments in Western Canada. The pumping requirement raises doubt whether the high-lift areas would be utilized in the foreseeable future. This is a matter of concern to the Commission, in view of the likelihood that the irrigable area would turn out to be considerably smaller than anticipated, as a result of a possible decision in the future to curtail the Project, leaving unattractive, high-lift blocks undeveloped.

79. The South Saskatchewan Project has introduced the question of pumping water to dry land, as a new element in irrigation policy in Western Canada. Recent discoveries of oil and the possibilities of new economies in the exploitation of extensive coal deposits suggest the advisability of definitive studies of the cost of power for pumping as a means of extending the limits of irrigation in the future. Of particular value in this connection would be studies of the feasibility of introducing irrigation schemes in Palliser's Triangle. The maximum use of the South Saskatchewan River for irrigation purposes in the future will depend upon economical pumping of water.

Recovery of Costs

80. Another feature of the Project is that the capital costs would not be recovered in any degree that can at present be foreseen. The division of costs on large irrigation projects was determined by P.C. 2298, June 19th, 1947. A capital investment of some \$140,000,000 in the main works of the Project would be borne by the taxpayers of Canada, and would not be recoverable. The

canal distribution system and pumping facilities would be provided by the Province of Saskatchewan, and the degree that these costs, along with the cost of land acquisition, amounting to about \$85,000,000, would be recovered would depend upon policies adopted by the Province. In Alberta's irrigation developments the purchase price for a water right has varied for different projects from \$10 to \$20, and has been fixed recently for the St. Mary River Project at \$10 an acre, payable over a period of years. The annual rate for operation and maintenance averages for all projects approximately \$2 an acre. There would be, therefore, virtually no recovery of capital costs, except with respect to the power plant, which is estimated to cost \$24,000,000.

Immediate Effects upon the Economy

81. The cost of the construction of the South Saskatchewan River Project in current prices has been estimated at \$247,900,000. The impact of such an expenditure upon the economy may be analysed by relating it to the total volume of similar expenditures that are currently being made in the economy and the region. The real cost to the community of any specific investment is measured by the amount and value of other goods and services that it must deny itself in order to make the investment. With relatively full employment, no new physical assets can be created without diverting labour and other resources from their current employment. Society must then do without the production that is lost by this transfer and this represents the real cost to it of the Project. When labour and

other resources have no employment opportunities they can be utilized for the production of goods and services which thereby are secured without any real cost to the community. This is one aspect of the argument that the best time for heavy investment of public money is during a period of business recession.

82. If construction were completed in eight years, as originally contemplated, the main works would involve annual expenditures of about \$17.5 millions during the first five years, rising to about \$32 millions in the seventh and eighth years when the power plant and irrigation works were begun. In comparison with these amounts, the value of new construction in the Prairies in 1951 was \$499 millions, with \$196 millions of this total spent on engineering construction of all types. Government expenditures on engineering construction in the Prairies were \$83 millions, or about 40 per cent of all expenditures of that kind. For the country as a whole, the value of engineering construction in 1952 was forecast at \$1,071 million. Since mid-1950 the costs of construction have been rising rapidly. It is difficult to evaluate in money terms the effects of a new project as substantial as the South Saskatchewan River Project upon the national economic welfare, and to determine whether or not employment conditions would be such that it would enlarge the inflationary pressures upon the economy. Government policy, however, at the present time is to postpone public construction projects that can be deferred on the grounds that the current high level of investment demand is an important factor in the prevailing inflation. Under present conditions, public investment adds to the pressure

upon the price level. Construction of the project should be considered only in relation to its timing in such a way as to *minimize* its real cost and to avoid increasing inflationary pressures in the economy.

83. The major material requirements for the Project are the various types of earth fill. These are available in quantity at the proposed site, as are aggregates required for the concrete. The rock required for riprap may have to be brought from the Frank Slide in Alberta. There is no problem in its supply. The Project would require about one million cubic yards of concrete. The cement would be supplied from the Exshaw, Alberta, and Winnipeg plants, having a combined capacity of 17.6 million bags per year by 1953. The largest annual requirement would be 2.5 million bags, and officials of the industry indicate that given advance notice, this amount could be met without affecting the price of cement. Three types of steel are required; reinforcing steel, steel plate and structural steel. In terms of domestic capacity, the demand for reinforcing steel represents a very small portion of annual output. The demand for steel plate in the two years during which it would be placed is only about five per cent of present capacity. The structural steel is of standard sizes and the requirements are relatively small. The three types of steel are produced in the central provinces and, with respect to fabrication, there is ample plant capacity in the Prairie region except for steel plate, which would have to be fabricated in Montreal.

84. Construction firms engaged in earth moving projects are among the most mechanized enterprises in the construction field. It is estimated that about \$10 million

of equipment would be used on the site of the Project, with about \$5 million worth assembled at the outset and maintained throughout the job. Certain heavy items would have to be imported from the United States, representing the only major leakage to import markets of the total expenditure for the Project. These requirements represent a relatively small proportion of the annual expenditures on this type of machinery and equipment.

85. Of all the factors required, labour emerges as the only one in critical supply. There is not a large group of construction labourers in the Prairie region and, at the present time, these are fully employed during the construction season as construction activity and resource development are maintained throughout the area. The construction season coincides with the seasonal demand for farm workers. Some difficulty of assembling the necessary labour force and some pressure on wage rates would likely be encountered if the Project were initiated under present conditions.

86. Since the real cost of the Project depends upon the conditions of employment for the economic resources it requires, it is evident that such cost would be heavy at the present time when Canadian resources are relatively fully employed. It is a public Project of very slow fruition and one which will have an indefinitely long life following its development. Variation within a period of a few years in the date of its completion would not greatly affect the value of its yield. Consequently, timing its construction to minimize its real cost would maximize the net benefit or return to the Canadian people. The best timing for the Project would be a period of slackening employment.

The Direct Economic Benefits

87. In considering whether the economic and social benefits of the South Saskatchewan River Project are commensurate with the cost, the Commission was entrusted with an undertaking in economic analysis for which the techniques of measurement are not fully developed. The benefits of the Project are the primary and direct returns obtained from farm production and a number of other benefits. These include the generation of hydro-electric power, the provision of municipal and industrial water supply, stream and flood control, and recreational facilities.

88. Primary and direct returns arise from the creation of irrigated land and its productive use. These returns are easily identified and they are measurable in the same way that returns on private investment are measurable through calculations of future events. The margin of error in measuring the direct benefits of irrigation is somewhat larger than in most investment opportunities only because the time of construction, colonization and development is so long that assumptions regarding future prices and costs may be proven wrong. The projection of price levels in such a case, as the Saskatchewan Government warned, is "extremely hazardous". A study prepared for the Commission by Dr. K. A. H. Buckley of the Department of Economics, University of Saskatchewan, included estimates of direct returns to show several variants. (Part II, chapter 8.)

89. The time lag between construction of an irrigation project and its full development is of paramount importance in appraising the economic benefits. Production experi-

ence in irrigation farming in Western Canada shows that the evolution of a project involves three stages:

(1) A developmental stage of about five years in which water use and basic practices are being established.

(2) A transitional stage in which land and water uses are improved and crop specialization is established. In Alberta this stage has often involved two generations of irrigation settlers and periods of 30 to 50 years.

(3) The mature stage, in which the full effective use of water is established. This stage can hardly be reached before the year 2000 in the South Saskatchewan Project, if started in the next year or two.

In an agronomic sense, the different stages may be seen in the existence of three types of farms in the irrigated areas, namely, the wheat-cereal farm, the mixed grain and live-stock farm, and finally the specialized farm producing the most valuable crops that can be grown in the Western Canadian irrigated areas, such as sugar beets and canning vegetables. Even at maturity, an irrigation project in Western Canada cannot be expected to be devoted entirely to specialty crops. In fact, the feed and livestock type of farm may represent the most desirable development for most of the available irrigated acreage, if optimistic forecasts of Canadian meat requirements for domestic and export markets are fulfilled. In the South Saskatchewan drainage area today, where irrigation has been practiced on an increasing scale for half a century, the irrigated area amounts to more than 610,000 acres. Of this total, about ten per cent is devoted to specialty crops. According to forecasts prepared for the P.F.R.A., the acreage in *effective* production

of high-return crops on specialty farms at the final "mature" stage of development of the South Saskatchewan Project would be 23,700 acres. In the analysis referred to, this figure has been doubled, on the ground that it is not unreasonable to assume that the future demand for food may warrant a more optimistic projection.

90. Other assumptions made are, on the whole, more optimistic than those made in earlier studies. The construction period of the Project, originally ten years, was reduced by the P.F.R.A. consultants to eight years when the question was referred to them. Mannix Ltd. suggested six and a half years. Dr. Buckley's analysis assumed eight construction seasons, allowing for delivery of water for irrigation in the 1959 season. Full development of the irrigated area could be reached in 50 years, it was assumed, rather than 60 years. In regard to future prices, it was assumed that the 1921-40 average, which includes the years of extremely low prices from 1930 on, could not be relied upon as a guide to the future. Instead, the 1921-48 average would serve better, and for the purpose of comparison, 1951 prices were also taken, since the existing degree of inflation in both farm prices and construction costs is about the same. If this was an error on the optimistic side, it could be argued that an assumption based on a substantial decline in relative prices for agricultural products would eliminate the economic justification for any extension of agriculture resources in Canada at all.

91. The size of farm assumed in the earlier study included 144 irrigated acres. For the present analysis a 30 per cent increase in the size of farm at full maturity was included in

some of the projections employed in order to protect the Commission's findings against undue pessimism in its assumptions. The variants assumed in the estimate of direct returns from the irrigation project show the following results:

GROSS RETURNS PER IRRIGABLE ACRE AFTER COMMENCEMENT OF IRRIGATION

	Year 3 (initial)	Year 20 (transi- tional)	Year 35 (mature)
At 1921-40 prices	\$ 0.23	\$ 1.39	\$ 4.09
At 1921-48 prices	3.19	5.14	9.66
At 1951 prices	9.21	14.11	21.45

These figures are subject to deductions for annual maintenance and operating costs, and this is assumed to be \$2 an acre, without pumping. However, as the South Saskatchewan Project involves pumping for three out of five acres, the average operating cost must be increased by \$2 an acre, making a total of \$4 an acre. The result of applying this average cost figure to the gross returns as estimated is evident. The returns if prices prevailed at the 1921-40 average would be barely sufficient to pay operating costs even at the stage of mature development of the Project. If the 1921-48 prices represent an average likely to prevail in future, the estimated returns would not be sufficient until after 20 years of progressive development to pay operating costs including pumping. These calculations do not include capital charges. If 1951 prices may be taken as the norm, estimated returns would be sufficient to repay current costs and provide net income to contribute to capital costs and to the farmer's profit.

92. On the basis of the more optimistic variants, the annual earning power of the

land, or net rent per irrigable acre, may be calculated with the following results:

	Year 3	Year 20	Year 35
1921-48 prices...	\$ 1.69	\$ 2.84	\$ 7.36
1951 prices	7.21	10.04	17.38

Ignoring the risks in projecting future prices, the net return per acre may be capitalized at the current Federal interest rate to estimate the per-acre value of irrigated land:

	Year 3	Year 20	Year 35
1921-48 prices .	\$ 48.33	\$ 88.22	\$210.55
1951 prices ...	206.21	287.14	497.07

In terms of the entire irrigable area of the Project, the estimated land values in millions of dollars are:

	Year 20	Year 35
1921-48 prices	\$ 37	\$ 96
1951 prices	131	226

The total annual earning power in millions of dollars for the entire area is as follows:

	Year 20	Year 35
1921-48 prices	\$1.3	\$3.4
1951 prices	4.6	7.9

These values show the share of the over-all cost of the Project that may be borne by the increase in agricultural production. They are subject to a deduction for the value of the same land in its present use for dry farming production. In its present use the land in the irrigable area is currently valued at about \$20 an acre, that is, \$9,100,000 for the irrigable area.

93. Deducting the most optimistic estimate of the value of the power plant (\$30,000,000) and the saving with respect to municipal water supplies (\$4,000,000) from the total cost of the South Saskatchewan River Development leaves a remaining cost of \$214,000,000. Some part of this \$214,000,000 will be offset by the direct

returns to irrigation. The remainder, that is, the deficit after deducting the irrigation returns, represents the cost to the people of Canada of the various indirect economic and social benefits associated with the Project. The annual interest costs on \$214,000,000 at the present Federal, long-term interest rate ($3\frac{1}{2}\%$) is \$7,490,000. On the basis of the projection of 1921-48 prices, the annual deficit would be approximately \$6,200,000 in Year 20, and \$4,100,000 in Year 35, at which level it would presumably remain indefinitely. The accumulated interest deficit, ignoring compound interest, would be \$190,000,000 in Year 35. On the basis of the projection of the 1951 prices, the deficit would be approximately \$2,900,000 in Year 20, zero in Year 33. After Year 33 an annual surplus of \$400,000 would emerge. Again ignoring compound interest, the cumulated deficit in Year 33 would be \$109,000,000.

Hydro-Electric Power Values

94. The development of hydro-electric power at the South Saskatchewan Dam has been an ancillary objective of the Project since the first engineering studies of it were prepared. The *Interim Report* of May 30, 1947, said: "The primary use of this Project is, of course, for irrigation". This report provided for the ultimate installation of 119,500 h.p., developing 416,000,000 K.W.H. of electrical energy annually for sale in the initial stages of development. At full development, the power capacity required for pumping was estimated to be 87,300 h.p. At that stage, 210,000,000 K.W.H. annually would be available for sale. "It is evident,"

the report said, "that power will be an important factor in this development." Another report, in November, 1949, assumed that the installed capacity would be 150,000 H.P., that 400,000,000 K.W.H. annually of firm energy would be available in addition to the energy needed for pumping. This report added: "The output would drop to about 300,000,000 K.W.H. during periods of low flows." Subsequently, Professor David Cass-Beggs, of the University of Toronto, prepared a report on power aspects for the Saskatchewan Government. The estimate put forward by J. W. Tomlinson, chairman of the Saskatchewan Power Corporation, in January, 1951, was a compromise of the figures of the P.F.R.A. and Cass-Beggs. Mr. Tomlinson's estimate assumed that the power plant would produce 250,000,000 K.W.H. annually of firm power, worth 5.5 mills, and 75,000,000 K.W.H. of secondary energy worth 3 mills. These values would produce \$1,600,000 gross revenue annually. The *Summary Report* of the P.F.R.A., April, 1951, assumed that capacity of 150,000 h.p. would be installed, and the plant would produce 375,000,000 K.W.H. annually of firm energy. This would be subject to deduction of 50,000,000 K.W.H. required for pumping, at full development, giving 325,000,000 K.W.H. of commercial energy. In addition, there would be 100,000,000 K.W.H. of secondary energy. These figures were adopted in the Interim Statement submitted by the Government of Saskatchewan on April 30, 1952. Values were placed upon the estimated power of 5.5 mills for firm energy and 3 mills for secondary energy, providing gross revenue of \$2,237,500 annually at full development.

95. Pertinent estimates regarding the power plant are that it would cost \$24,000,000 and the operating costs, excluding capital charges, would be \$1,200,000 a year. If the resultant net incomes from power are capitalized at four per cent—the current long-term interest rate of the Province of Saskatchewan—the capital value created by the power project, as estimated for the purposes of the Saskatchewan submission, would be \$29,062,500 in the first year of operation of the plant. This would decline to \$25,937,500 in Year 20. These figures may be regarded as the share of the over-all cost of the Project that may be credited to the power development.

Municipal Water Supply

96. The improvement of municipal and industrial water supplies is an important, though secondary, feature of the Project. The cost to the Federal Government, under the commitment to maintain the level of Buffalo Pound Lake as a water supply for Regina, Moose Jaw and other municipalities, would be reduced if the lake level were controlled from the South Saskatchewan reservoir rather than by pumping from the South Saskatchewan River. An annual pumping charge of \$150,000 would be eliminated. This represents a capital sum at $3\frac{1}{2}$ per cent of \$4,290,000. This sum may be regarded as a credit to the Project, offsetting the cost.

Other Benefits

97. The South Saskatchewan Project would facilitate the control of the natural flow of water in the river, consequently

improving the potential power sites and reducing the danger of flooding downstream. These are real though intangible benefits for the most part, impossible to measure in financial terms. It is evident from the *Summary Report* of the P.F.R.A. that a considerable improvement of the water flow and of the quality of water in the Qu'Appelle Valley would result from the Project on the South Saskatchewan River. At flood stages of the river, there is recurring danger of flood damage south of Saskatoon and at the city itself. In addition, the useful development of delta land in the lower reaches of the main Saskatchewan River, both in Saskatchewan and Manitoba, will require all the advantages of flood control that can be reasonably obtained. Yet flood control, as the Province of Saskatchewan asserted, does not lend itself to accurate dollars-and-cents measurements. It is not possible to make an estimate of the value of flood control resulting from the Project.

98. The improvement of potential power developments downstream from the main reservoir of the Project should result in an increase in the recovery of energy. Calculations to this effect have been submitted by the Province of Saskatchewan. The Commission feels, however, the accompanying data were hypothetical and insufficient as a basis to evaluate the effect of the main reservoir upon sites at Fort a la Corne, Nipawin, Squaw, Batoche, Coxby, Dauphin River and the Nelson River. Some of these sites are probably marginal, and would remain uneconomic in spite of an improved flow. The results of control of the river, moreover, would have to be considered in relation to the loss of energy resulting from depletion,

or consumptive use, of the flow by the irrigation of land. The view of Manitoba was expressed in these words: "It is quite possible that this Project could cause a serious decline in the potential capacity of the power sites on the Dauphin and Nelson Rivers." D. M. Stephens, formerly Deputy Minister of Mines and Natural Resources in Manitoba, pointed out, in an analysis of Manitoba's water problems, the risk "that a drastic reduction of flow in the low water years might very easily change the Dauphin River scheme from an economic to an uneconomic undertaking". The direct loss to Manitoba of diversions from the Saskatchewan River, which have been proposed for irrigation purposes, would amount to 440,000 firm horsepower, according to Stephens. Such a loss would be felt severely in Manitoba, where alternate sources of power are lacking. The Commission recommends therefore that the engineering studies required to evaluate the downstream effects of river development should be undertaken.

99. Income benefits to dry land producers associated with the Project, though indirect, would be of considerable importance, especially at a time of general drought in Western Canada. The neighbouring territory would furnish to the Project a supply of pasture, labour and equipment services. On the other hand, the Project area would serve as a source of seed, feed and farm produce and as a limited market for livestock. The Commission calls attention to the view, expressed by Professor Van Vliet, that the information required to appraise these indirect and imponderable benefits is seriously limited. An enterprise in resource development on the

scale of the Project, however, would have far-reaching results throughout the region in which it is located.

100. The South Saskatchewan Project would create employment opportunities for agricultural immigrant labour, whose wages would represent an addition to the national income of the people of Canada. The settlement of the Project, however, is not contemplated exclusively as an immigration scheme. To the extent that it represented a transfer of farm labour from one type of agriculture to another that offers superior alternative employment through higher wages, the Project would provide a net gain in national income. Whether the Project represents a more desirable form of resettlement of farm population than the opportunities available in virgin lands elsewhere can be settled only by examining alternative opportunities. The Commission did not regard such an inquiry as coming within its terms of reference.

101. The indirect returns from the Project enjoyed outside of agriculture would be substantial, though difficult to measure. Expenditures in the Project area are estimated to be approximately \$3,000,000 annually under dry farming conditions. These expenditures would increase three or four times, under irrigation farming. The impact of these expenditures would be diffused over a large variety of enterprises throughout the country. The same effect is achieved in relation to the irrigated areas of Alberta.

102. The South Saskatchewan drainage basin has become, on the whole, a region of declining population. The Project is one that would reduce the social and economic

costs of this phenomenon. The advantage of locating such a Project within an area of declining rather than expanding population is obvious, though it must be considered in relation to other tests of economic desirability. The capital equipment and established services available in the communities that would be affected by the Project would enjoy enhanced use if the Project were undertaken. This is one of the important though imponderable benefits to be credited to the Project.

103. The saving in farm assistance payments that would be rendered unnecessary by the South Saskatchewan Project has been estimated at \$368,100 annually. This amount should be regarded as a credit offsetting the costs of the Project. Its capitalized value is \$10,500,000.

104. Through an increase in production, the South Saskatchewan Project will increase the base of Federal taxation upon income. The extent of the increase has been estimated at \$800,000 annually in one case, at \$1,100,000 in another. These estimates, however, are subject to an important qualification in that the investment in the Project may well preclude other desirable investment which could produce a larger net income. The Commission asserts that if the Project is built under conditions of full employment, it would not necessarily produce a net increase in national income greater than the increase that would follow investment in other fields of production.

105. The social benefits of the South Saskatchewan Project are clearly discernible, though impossible to measure precisely. The number of dry land farms in the area that would be affected is 1,245, and these farms would in time be replaced by 2,700

irrigation units. The effect of more than doubling the number of farm families in the area would have far-reaching, beneficial consequences for at least a dozen towns and the City of Saskatoon. The result would be to arrest the decline in population in the region and provide the basis for closer community life. The enhancement of community amenities, of home surroundings and conveniences and the psychological stimulus gained in life in an expanding community restore vision and release new energies that are of high value. All these things follow from an assured supply of water in a dry region.

106. The recreational value of the South Saskatchewan Project is unique, even in a country as liberally supplied as Canada in facilities for the enjoyment of healthful leisure. It would create new facilities for hunting, fishing, swimming, boating, picnicking, camping and summer cottage life on a scale that is not readily available to a majority of the people of the dry plains. The validity of assumptions regarding the increase in recreational facilities is amply proven by reference to similar indirect benefits from irrigation enjoyed by the people of irrigation areas in Alberta. There is one important qualification that should be borne in mind. It arises from the consequences of drawing down the water level in the main reservoir during the months in which the inflow will not be sufficient to maintain a constant level. The shoreline of the main reservoir will be subject to fluctuation, as the water level in a dry year may be drawn down 20 or 25 feet. The shore conditions may require special measures such as the creation of artificial beaches. The chief beneficiary of the Project from a recreational

point of view would likely be the Qu'Appelle Valley with its succession of lakes and Last Mountain and Little Manitou Lakes, and its established tourist facilities.

Summary of Costs and Benefits

107. A balance sheet of the benefits and costs of the South Saskatchewan Project cannot be presented owing to the immeasurability of many of its indirect effects. However, a summary of the financial position of the Project at maturity may be drawn up as follows:

Original capital cost (Year 1)	\$247,900,000
ADD:	
Land acquisition (Years 1-20)	9,100,000
	<hr/> 257,000,000
DEDUCT:	
Capital value of power (Year 35)	26,000,000
	<hr/> 231,000,000
Municipal water service (Year 35)	4,300,000
	<hr/> 226,700,000
Relief savings (Year 35)	10,500,000
	<hr/> 216,200,000
ADD:	
Accumulated deficit (Year 35: simple interest, 1921-48 prices)	190,000,000
	<hr/> 406,200,000
DEDUCT:	
Land value of irrigated area (Year 35: 1921-48 prices)	96,000,000
	<hr/>
Balance—deficit at Year 35	\$310,200,000

This summary includes only those returns to the Project that are assured and measurable. While the estimates are subject to error, they serve to illustrate the prospective status of the Project on the basis of one

possible set of assumptions. These assumptions included the most favourable submitted to the Commission regarding the value of the power development, and the most optimistic of the P.F.R.A. estimates of agricultural returns.

108. No estimate of the net gain in the revenues of government is included in this summary because such a gain is certain only if the investment in the Project did not restrict investments of equal magnitude in other projects, as it would tend to do under full employment conditions. Furthermore, in the absence of full employment, any increase in governments' revenues would be offset to some unpredictable extent by a concomitant increase in the expenditures by governments. Finally, any net increase in the revenue of governments represents a deduction in the private revenues or incomes created by the Project.

109. Certain adverse effects are omitted from the summary because of their immeasurability. Among the more important of these are the virtual losses of value that would be imposed on some agricultural lands in the region as a result of the superior competitive position of the Project, particularly with respect to prairie markets for dairy and livestock products. The adverse effect of the use of the river for irrigation upon the value of power sites below the damsite is also ignored; but this adverse effect would be partially offset by the beneficial effect of improved stream control.

110. The deficit reflects the cost to the Canadian people of the various indirect and social benefits associated with the Project. These include:

- (a) additional income accruing to associated dry land producers;

- (b) indirect income benefits enjoyed by producers in the irrigable area;
- (c) the net additions to the national income arising with new opportunities that might be created for the employment of labour and capital outside of agriculture as a result of a more stable and higher level of farm spending in the area;
- (d) the creation of opportunities within agriculture for some 1,500 families;
- (e) the increase in population and its implications for closer community life in the area;
- (f) the enhanced opportunities for recreation; and various other social benefits described in this Report.

The Qu'Appelle Valley

111. The development of the historic Qu'Appelle Valley as an irrigation project with an irrigable area of 24,000 acres is a prominent feature of the South Saskatchewan Project. In addition to the irrigation benefits that may be gained in the Qu'Appelle Valley, its development represents almost the entire claim made on behalf of the Project with respect to future supplies of water for municipal and industrial purposes in the cities of Regina and Moose Jaw and numerous other communities in south central and southeastern Saskatchewan. The Qu'Appelle Valley contains six large lakes. Associated with it are Last Mountain Lake and Little Manitou Lake, and Katepwa and Little Manitou Provincial Parks. Regulation of the flow of the Qu'Appelle River, with maintenance of the levels of these lakes, would safeguard and greatly enhance the amenities of the Valley

region. The Commission points out that the Federal Government has already accepted a commitment to maintain the level of Buffalo Pound Lake for the purpose of urban water supply. This will involve either the installation of pumping facilities to lift water from the South Saskatchewan River, or some other development. The City of Regina is engaged on the construction of extensive works to pipe water from Buffalo Pound Lake. If the South Saskatchewan Project were built, Buffalo Pound Lake could be fed by gravity from the large reservoir. This would create a saving in pumping costs to offset, to a relatively modest degree, the cost of the larger Project. The entire range of benefits available from the regulation of the Qu'Appelle River can be achieved by due foresight in the provision of pumping or other facilities on an adequate scale. The Commission recommends that the full development of the Qu'Appelle River be undertaken immediately on the basis of an assured level in Buffalo Pound Lake.

The Delta Region

112. The desirability of extending the frontiers of agricultural production in Western Canada has been called to the Commission's attention. As an essential of public policy, the Prairie Provinces will be concerned for some years to come with programs of clearing and breaking new land. It should be noted that the logic of national development does not, in itself, serve to commend a particular undertaking such as the South Saskatchewan River Project. So rich and varied are the opportunities in

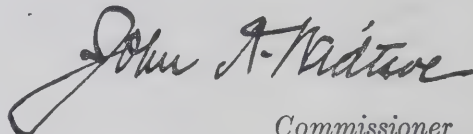
Canada, both to bring new land under cultivation and to apply intensive methods, that new sources of food production may be opened up as quickly and as cheaply as anywhere in the world. Though irrigation results in making land available for the production of food, the Commission's reference did not require it to search for alternative sources of new land. It was invited, however, to consider the problem of land reclamation in the fertile delta region of the Saskatchewan Basin. The opportunity presented to the people of Canada in this delta region is related closely to the problem of beneficial use of the resources of the river's drainage area. The delta, lying within the forks of the Saskatchewan, the Carrot and the Pasquia Rivers particularly, bestrides the Saskatchewan-Manitoba boundary. This delta contains much fertile land, created by the action of the river through countless years. It requires the protection of dykes against recurrent flooding and, in addition, some drainage works. The future development of mining and other industries in Northern Saskatchewan and Manitoba justifies an energetic effort to utilize the productive potential of the delta region. For relatively low expenditures, a large block of rich delta land can be reclaimed. The Commission recommends, therefore, that the appropriate works should be undertaken

immediately to permit the settlement of 75,000 to 100,000 acres between the Saskatchewan and the Pasquia Rivers, adjacent to The Pas.

Respectfully submitted,




Chairman.



Commissioner



Commissioner

October 29, 1952. 

NOTE: The death of Dr. John A. Widtsoe occurred in Salt Lake City on November 29, while the report was being printed.

PART II

The River Basin and Its Development

Introduction and Acknowledgments

THE members of the Commission have been profoundly impressed by the magnitude of the proposed South Saskatchewan River Project and its estimated cost. The Project would transform, in part, the region in which it would be situated. As an enterprise in resource development, the concept of employing the physical resources of the Saskatchewan River Basin in "the most profitable and desirable" way has few parallels in Canadian experience. At a time when the conservation of water has become a pressing problem in many regions of North America, an inquiry such as the Commission was requested to carry out involves matters of interest and significance to the Canadian people.

The Commission's inquiry appeared at first to fall into two distinct parts, namely, whether the economic and social returns would be commensurate with the cost of the Project, and whether it represents the most profitable and desirable use which can be made of the physical resources involved. Many important and varied factors involved in the inquiry, however, are pertinent to both questions.

The Commission's inquiry was organized at a first meeting in Ottawa, a few days after the Commission was established by Order in Council P.C. 4435, August 24, 1951. The

Commission received voluminous reports from the administration of the Prairie Farm Rehabilitation Act on many phases of the Project. The task of reviewing the material supplied by the P.F.R.A., without which the inquiry could scarcely have been undertaken, occupied much more time than had been expected.

The scale of these reports may be judged from the following list:

1. Report on Recreational Benefits. Progress Report. By J. A. Boan, prepared for P.F.R.A.
2. The Development of Irrigation in Alberta. An Historical Survey. By C. S. Burchill, Dominion Economics Division, University of Alberta, Edmonton, Alta.
3. Power Report. Central Saskatchewan Development. By David Cass-Beggs, P.Eng.
4. The Climate of the South Saskatchewan Irrigation Project. By B. W. Currie, Ph.D., University of Saskatchewan, Saskatoon, Sask.
5. Engineering Features of the South Saskatchewan Irrigation Project. By G. L. MacKenzie, Chief Engineer, P.F.R.A., Regina, Sask.
6. Soil Survey Report of the South Saskatchewan Irrigation Project (revised—1949). By H. C. Moss, W. K. Janzen and J. E. McClelland, University of Saskatchewan, Saskatoon, Sask.
7. Land and Development Policy for Newly Created Irrigation Districts with Special Reference to South Saskatchewan Development Area. By C. C. Spence, Dominion Economics Division, University of Alberta, Edmonton, Alta.
8. Study of the Irrigation Phase of the Proposed South Saskatchewan River Development Project. By H. Van Vliet, Gordon Haase and R. A. Stutt.

Meanwhile, the Commission undertook to notify, through the medium of personal calls by one or more members and the Secretary, the Governments of Manitoba, Saskatchewan and Alberta of the purposes of the inquiry and to invite them to submit views relative to the terms of reference. Subsequently the Provinces of Saskatchewan and Alberta filed comprehensive submissions, the former expressing its views initially in an Interim Statement which was followed, four months later, by a longer submission. Several meetings were held with Ministers or officials of the Manitoba Government, with the result that the views of Manitoba were obtained. A letter was received from Premier Campbell, setting out the considered view of his Government on the matters under inquiry.

These statements are found in the Appendix to this Report. The Commission desires to express its thanks to the Provincial Governments which, being concerned with the development of the Saskatchewan River Basin, assisted materially in the inquiry.

In addition the Commission requested reports from qualified persons on specific subjects. These form Part II of the Report. The Commission unfortunately found that a large amount of written reports could not be included in this Report in convenient and readable form. Such data and conclusions as are necessary to the Report will be found in references to and quotations from this material. The studies undertaken for the Commission include the following:

1. Full Development Possibilities in Saskatchewan River Basin. By W. M. Berry, Chief Hydrologist, Department of Agriculture, Regina, Sask.
2. Short-Run Effects of the South Saskatchewan River Development. The Question of its Real Cost. By K. A. H. Buckley, Ph.D., Department of Economics, University of Saskatchewan, Saskatoon, Sask. Also Long Run Economic and Social Benefits of South Saskatchewan River Project, same author.
3. The Economic Development of the Prairie Provinces with Particular Reference to the South Saskatchewan River Basin. By Vernon C. Fowke, Department of Economics, University of Saskatchewan, Saskatoon, Sask.
4. The Economic Basis for Past Irrigation Expenditure in Alberta. By Hu Harries, Edmonton, Alta.
5. Memorandum Relative to an Enlargement of the Proposed Reservoir at Outlook, Saskatchewan, and to the Red Deer Project. By D. W. Hays, Medicine Hat, Alta. Memorandum Respecting Irrigation Requirements and Water Supply. By D. W. Hays, Medicine Hat, Alta.
6. The Geographical Setting. Saskatchewan River Drainage Basin. By the Geographical Branch, Mines and Technical Surveys Department, Ottawa.

The Commission deemed it advisable to arrange a conference with the senior engineering consultants of the P.F.R.A. on the Project, and this was done. The conference, held in Washington, D.C. in April, 1952, was attended by a number of officials and advisers of the P.F.R.A. and, as well, an observer from the Saskatchewan Government. This conference served to clarify many engineering aspects of the Project, and confirmed the Commission in a decision to obtain an independent estimate of the overall cost. Those attending the conference in Washington were:

Dr. T. H. Hogg, Chairman
 G. A. Gaherty, Commissioner
 B. T. Richardson, Secretary
 Gordon Haase, Commission Economist
 D. W. Hays, Commission Consultant
 Miss M. A. Mosley, Asst. Secretary
 Major General H. B. Ferguson, Cons. Engineer, Washington, D.C.
 Dr. A. Casagrande, Harvard University, Cambridge, Mass.

L. F. Harza, Harza Engineering Co., Chicago.
G. L. MacKenzie, Chief Engineer, Prairie Farm
Rehabilitation
G. Parkinson, P.F.R.A.
R. O. Peterson, P.F.R.A.
J. G. Watson, P.F.R.A.
Dr. J. D. Mollard, P.F.R.A.
W. T. Pyott, Chief Engineer, Mannix Ltd.
O. M. Strange, Engineer, Morrison-Knudsen Co. Inc.
O'Dean Anderson, Engineer, Morrison-Knudsen Co.
Inc.
J. W. Tomlinson, Gen. Mgr., Saskatchewan Power
Corp., Regina.
W. B. Ramsay, President, Beattie Ramsay Con-
struction Co. Ltd.
D. S. MacDonald, Gen. Mgr., Bird Construction
Co. Ltd.

For the preparation of an estimate of cost, which will be found in Part II of the Report, the Commission retained Mannix Ltd., Calgary, Alta. The Commission desires to express its thanks to Mr. Fred Mannix, Jr., Mr. Wm. T. Pyott and Mr. R. Walford of that firm for their assistance. The preparation of the cost estimate by Mannix Ltd. was undertaken and completed, at the request of the Commission, in a far shorter period of time than would normally be required for work of this kind.

As will be seen from the letter accompanying the estimate furnished by Mannix Ltd., a number of United States firms assisted with advice based upon experience directly related to large-scale construction projects similar to that under inquiry by the Commission. The Commission desires to thank the individual members of these firms who assisted in preparing the estimate.

The Commission desires to express its thanks to the United States Bureau of Reclamation and its Commissioner, Mr. Michael Straus, for much valuable material

and for the courtesy of a conference with Mr. Straus and several of his key advisers at the Bureau's offices in Washington, D.C., in April, 1952.

To many staff members of the P.F.R.A. the Commission's inquiry has meant extra work during the past year. The Commission desires to thank all of them for their courteous co-operation and to single out particularly Dr. L. B. Thomson, the Director, Mr. Gordon L. MacKenzie, the Chief Engineer, and of their staff, Mr. George Munro, Mr. Gordon Watson and Mr. Wm. M. Berry. In reviewing material, in discussing the inquiry and in inspecting the Project site, the assistance of the P.F.R.A. organization has been invaluable to the Commission.

The Commission held public hearings at Lethbridge, Alberta, on May 2, 1952, obtaining a valuable insight into the progress and problems of the established irrigation projects in Alberta. Those who came forward and testified included Dr. W. H. Fairfield, Messrs. Phil Baker, P. M. Sauder, C. Clendenning, A. E. Palmer, W. L. Jacobson, and Wm. M. Berry. The Commission desires to thank these experienced irrigators for their assistance to the inquiry.

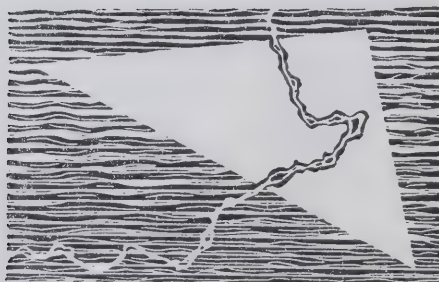
Public hearings were held at Outlook, Sask., on Sept. 9, at Regina, Sept. 10 and 11, and Saskatoon, on Sept. 12. A list of those who appeared will be found in the Appendix to this Report, along with the text of numerous submissions. The Commission has sought to weigh carefully all the data received and wishes to express its thanks to all those who came forward to present their views.

A number of Departments of the Federal Government have supplied valuable assistance to the Commission, both in loaning personnel and furnishing information from time to time. Wherever possible, credit for such assistance has been given at the appropriate place in the Report. Two members of the Department of Agriculture who have rendered exceptional service to the Commission in its inquiry and in the preparation of its Report have been Mr. Gordon Haase and Dr. Kenneth W. Hill.

In the preparation of the Report, a brief account of the geographical setting of the South Saskatchewan River Development was furnished by the Geographical Branch, Department of Mines and Technical Surveys, under its director, Dr. J. Wreford

Watson. The assistance of this Branch in the preparation of maps included in the Report was invaluable. Much of the work of preparing the maps was done by staff members of the Branch, in addition to their regular duties. The Commission desires to express its thanks to the Deputy Minister of Mines and Technical Surveys, Mr. Marc Boyer, to Dr. Watson, and to the chief cartographer of the Branch, Mr. Paul Laurendeau, who directed the technical work of producing the maps.

Finally, the assistance given to the Commission by Mr. David W. Hays of Medicine Hat, Alberta, has been of particular value in view of Mr. Hays' long experience in practical irrigation in Alberta and his wide knowledge of all aspects of the subject.



The Geographical Setting

IN A country of great river systems, the Saskatchewan River ranks as the fourth longest in Canada. The Mackenzie is the longest, followed by the St. Lawrence and the Yukon. Since the Mackenzie and the Yukon lie north of the more densely settled areas, the Saskatchewan is the second longest river in the settled part of the country.

From its source in the eastern ranges of the Rockies, the river flows across the three Provinces of Alberta, Saskatchewan and Manitoba, and empties into the north end of Lake Winnipeg. Here the Saskatchewan proper ends, but its waters travel another 400 miles as the Nelson River before reaching salt water at Hudson Bay. Altogether the watershed of the Saskatchewan River covers about 148,000 square miles or 95½ million acres. In its immense extent, the basin runs through 18 degrees of longitude, from 117 degrees west to 99 degrees west and through 5 degrees of latitude from 49 degrees north to 54 degrees north. This great longitudinal and latitudinal extent gives rise to greatly diverse geographical conditions within the watershed as a whole.

The Saskatchewan River is made up of two main branches referred to as the North Saskatchewan and the South Saskatchewan or the North Branch and the South Branch.

Each of these has numerous tributaries. Two of the larger tributaries of the North Branch are the Brazeau and the Clearwater; the South Branch has a number of large tributaries, in particular the Oldman, the Bow and the Red Deer.

The Columbia Ice Field, the largest glacier left in Canada, gives rise to both branches within half a mile of each other. Some of the southern tributaries rise in Glacier National Park in Montana. The two main branches, despite a common origin, diverge until they are 300 miles apart. Then they begin to converge until, 800 miles later, they sweep together at the Forks, east of Prince Albert in Central Saskatchewan. The main stem runs thence another 340 miles before emptying into Lake Winnipeg.

The watershed of the North Branch is 82,500 square miles in extent, covering 52,800,000 acres. The watershed of the South Branch is somewhat smaller, with an area of 65,500 square miles covering 41,920,000 acres. The North Branch occupies 56 percent of the whole drainage system, and the South Branch 44 percent. The watershed of the Saskatchewan River system and that of the Nelson drain almost all of the Canadian prairies below the 54th parallel.

To the north are the Mackenzie-Athabasca-Peace systems. To the southeast is the Qu'Appelle-Red River system and to the south the Missouri system. The western side of the basin is bounded by the eastern ranges of the Rocky Mountains, with the Columbia River system just over the divide.

Relief

In the main the watershed is underlain by nearly horizontal strata of Tertiary and Cretaceous rocks, and towards its mouth by Silurian and Ordovician formations. These have been little affected by the faulting and folding which are so evident in the western part of the basin.

The elevations across which the watershed lies reflect very strongly the horizontal nature of the underlying strata. The whole of the plain of Western Canada slopes eastward and to the north. Three distinct levels of elevation are clearly marked, and are referred to as the three prairie steppes. The highest slopes eastward and northward from an altitude of 4,000 feet at the foothills, to 2,200 feet at its eastern limit marked by the Missouri Coteau. The Coteau or escarpment appears as dirt hills rising 300 feet to 500 feet above the surrounding prairie. It cuts across the watershed somewhat west of a line drawn through Weyburn and Moose Jaw. Erosion on this prairie level has proceeded further than on the other two prairie steppes. It has been worn down, in some areas, into rounded knob-like hills. Near the river, deep drains and coulees give rise to badland topography. This prairie level has much more broken relief than have the next two levels.

Relief within the watershed on the intermediate prairie level is that of a rolling

plateau with an average altitude of about 1,600 feet. The surface is scored by the deeply trenched river and is marked by frequent level lake-bottoms. The eastern limit of this level is marked by the Manitoba Escarpment. This feature rising to 2,000 feet appears as a line of hills, isolated from each other by many eastward flowing rivers. East of this and stretching across the Red River valley to the Canadian Shield is the lowest prairie level with an average elevation of about 800 feet. This flat, featureless plain corresponds closely to the bed of glacial Lake Agassiz.

The North Saskatchewan and the South Saskatchewan unite at the Forks, on the intermediate prairie level. From this point onward, the watershed narrows rapidly, and where it crosses the lowest prairie level it has an average width of only 60 miles. From the base of the Rockies to Lake Winnipeg the fall is more than five feet to the mile. The river is normally rapid in flow, except in numerous areas where drainage is poor or where only internal drainage exists.

Climate

The Saskatchewan basin lies in the Cool Temperate zone. The annual average temperature is about 36°F, varying from 31°F at The Pas to 42°F at Medicine Hat. The mean July temperatures indicate that the summers are as warm as 65°F, with some variation depending upon the specific locality. In winter, the mean January temperatures fall to two or three degrees below zero at Saskatoon, Prince Albert and The Pas, but are as high as 12-13 degrees above zero at such places as Calgary and Medicine Hat.

However, rainfall is probably a more important factor than temperature. The watershed area varies from semi-arid in the south and southwest to sub-humid in the north and northeast. Average annual precipitation varies from about 11 inches in the south to 20 inches in the north. It is highly characteristic of the watershed area that a high proportion of the annual rainfall comes in the growing season.

Climate has a direct bearing on vegetation and the character of the soils of a region. Soils are the product of the original material composing the surface of the region, modified by climate and vegetation. This correlation is borne out by a study of the vegetation and soil belts in the Canadian prairies.

Vegetation

In general, the southern part of the basin is marked by the short grass cover. This is the northward extension of the Great Plains region of the United States. This cover merges gradually toward the north into the grove or park belt, with its tall grass vegetational cover and patches of woodlands. Still further north, but well within the watershed, are the northwestern coniferous forests of spruce and poplar, tamarack, balsam and aspen. Southern extensions of this vegetation occur in the east and in the extreme west of the basin.

Soils

The soil belts cross the watershed at approximately right angles to the north-south relief features. In general these

arcuate soil belts range from the brown prairie soils in the south to the black prairie soils in the north part of the watershed, with the dark brown prairie soils in between. The transitional soils mark the gradual change from the black prairie soils to the grey podsol soils of the timber areas to the north. These are prominent along the north edge of the watershed and in the higher parts of the foothills and mountains in the west.

Thus the watershed area of the Saskatchewan River system contains within its boundaries, all the diversities in structure, climate, topography, drainage, natural vegetation and soils to be found in the whole Canadian prairies. Conditions and types of structure, drainage and topography are strongly marked from west to east while the changes in climate, natural vegetation and soils have their greatest variations from south to north. These changes of physical conditions become more apparent when one studies the watershed of the South Saskatchewan in detail.

South Saskatchewan Basin

The watershed¹ of the South Saskatchewan River, covering a drainage area of approximately 65,500 square miles, lies in the southern part of the provinces of Alberta and Saskatchewan. It is bounded on the north by the large drainage systems of its North Branch, on the east by the Qu'Appelle-Red and on the south by the Missouri in the U.S.A. To the west the boundary follows the Great Divide of the Rocky Mountains.

The greater part of the drainage area of the South Saskatchewan River system lies

¹ The term watershed is used here to describe the river and its tributaries, and is interchangeable with the terms drainage area, basin, and drainage basin.

in the southern part of the Province of Alberta. The basin narrows rapidly in its course through southwestern and south central Saskatchewan to the junction with the North Branch at the Forks.

In terms of geographical extent, the basin measures approximately 480 miles, from longitude 116°W. to longitude 105°W., and 300 miles at its widest extent, from below the 49th parallel, to 53°N. latitude.

The main stream of the South Saskatchewan River actually starts where its tributary, the Oldman, having gathered up the St. Mary, The Belly and the Waterton, joins the Bow, in southeastern Alberta between the cities of Lethbridge and Medicine Hat. The tributary streams, St. Mary, the Belly and the Waterton, take their rise in the mountains of Glacier National Park, below the border between Canada and the United States of America, the 49th parallel. The tributary streams, the Oldman, the Highwood, the Little Bow, and the Bow start on the eastern slopes of the Great Divide in southern Alberta. The South Saskatchewan has one other important tributary, the Red Deer. This river, rising in the mountains close to Bow Pass, unites with the main stream at the Alberta-Saskatchewan border. Here all the tributary streams, having spread out across the foot-hills and the prairies, unite again in the main stream of the South Saskatchewan.

The South Saskatchewan River system flows generally eastward, with many meanderings and turnings and in long curving reaches of five or six miles from one side of its valley floor to the other. At the town of Elbow in Saskatchewan, the main stream

turns sharply north and northeast and continues in this direction to its junction with the North Branch of the Saskatchewan River, some 60 miles east of Prince Albert.

Among the important cities within the watershed are Calgary, Lethbridge, Medicine Hat, Saskatoon and Swift Current.

Bed Rock Geology

The underlying geological structures are fairly simple. From a north-south line drawn through Cardston-Gleichen-Stettler, eastward, the whole drainage basin rests on a level Cretaceous platform with average elevation of 2,500' above sea level. This formation, occupying 78 per cent or 50,976 square miles of the basin and lying in relatively horizontal strata, is mainly sedimentary rocks. The underlying strata have not been much affected by folding and faulting until the Rocky Mountains are approached.

The higher lands in the western part of the watershed but east of the mountains, are formed by Tertiary beds. A broad band, 60 miles wide, runs north and south across the watershed from Cardston-Gleichen-Stettler watershed to a line running north and south through Pincher Creek to Turner Valley. These formations with an average elevation of 3,500' above sea level are Tertiary conglomerates, sandstones and shales, and occupy 15 per cent or 10,000 square miles of the basin.

The third main geological formation, running along the extreme west side of the watershed, consists of the sedimentaries of the Devonian and Carboniferous formations. Interspersed among these are extensive outcrops of Lower Cretaceous sedimentaries. These latter formations coincide with the

elevations of over 5,000' above sea level. The Devonian and Carboniferous formations and outcrops of Lower Carboniferous underlie seven per cent or 4,500 square miles, of the watershed.

The bedrock geology of the watershed is significant for three main reasons. The first is the economic importance of oil, coal, and natural gas. The second is the influence of the bedrock on the nature of the soils of the region and the third is the effect of the rock structure on the surface relief. This report will comment only on the last relationship. One of the most important effects of the underlying rock structure is revealed in part at least on the surface.

Relief

Physiographically, the western plains region, together with the foot-hills of the Rockies, are regarded as being the Interior Plains province. This broad physiographic division has a number of sub-provinces such as the Manitoba Lowlands on the east, the Cretaceous Plateau in the interior, the foot-hills on the west, and the Mackenzie Lowlands in the north. The South Saskatchewan basin lies across two of these sub-provinces, the foothills and the Cretaceous Plateau, with elevations as described above.

The absence of extensive folding and faulting accounts for the great areas of comparatively level lands, characteristic of the plains section within the basin.

The average elevation of the South Saskatchewan River basin varies considerably from the west to east and from north to south. In the extreme west the heights of the Rockies rise to over 5,000 feet and occupy six per cent of the basin, or 3,700 square

miles. Then, the relief drops quickly to the 4,000-foot level of the foothills. The foothills of the Rockies, with an average elevation of 4,000 feet above sea level, occupy 21 per cent or 13,800 square miles of the watershed area. The highest of the three prairie levels is from 3,000 down to 2,000 feet. It occupies the bulk of the basin, covering 61 per cent or 40,000 square miles. The watershed from the point where the river debouches through the Missouri Coteau lies in the intermediate prairie steppe. It continues to its junction with the North Branch, through an elevation from 2,000 to 1,500 feet. Contained in the watershed are 7,200 square miles of this relief level, comprising only 11 per cent of the total watershed area.

During glacial times, ice advanced across what is now the three prairie provinces from the direction of Hudson Bay and from the Rockies in the west. The record of this glaciation is evidenced in a series of ridges and moraines, together with englacial lakes all pointing south-east. All the lakes are long and narrow and all the streams including long stretches of the Saskatchewan run in that direction. In the north part of the basin most of the relief is due to glacial moraines forming morainic hills which rise 300 feet above the general level of the country. The development of the relief in the whole area appears to be pre-glacial since glacial action has modified rather than determined the land forms. The region was one of deposition during the glacial era rather than one of erosion. The relief features of the plains in a broad sense may thus be said to terminate with the ice age.

In general, the surface area of the Cretaceous Plateau is broken by low hills and ridges as well as trench-like valleys. Where

the plateau merges into the foothills west of the Cardston-Gleichen-Stettler line, the irregular topography becomes even more varied. Flat hills, remnants of the plateau further east, give way to irregular and rounded knobs, the result of erosional agencies playing on the twisted and broken strata. The topography outside the actual course of the river is marked by deep ravines cut in great thicknesses of gravel and other debris washed down during geological times, from the peaks to the west.

The Missouri Coteau is one of the more striking topographical features in the watershed. This steep eastward facing escarpment cuts diagonally across the watershed at the narrow neck at Elbow, Saskatchewan. This escarpment marks the eastern edge of the highest prairie level and has an average altitude of 2,500 feet above sea level. The line of hills which distinguish it are from 300 feet to 500 feet above the general prairie level. In contrast to the scarp's steep eastward facing slope is the gentler slope to the west.

An important feature on the southwest side of the Coteau is the old drainage channels occupied by long, narrow, shallow lakes. The lakes are remnants of much larger, late Pleistocene lakes, and lie in valleys that were formed by the run-off of glacial waters or lie in depressions in the morainal areas. Most of them are undrained and alkaline. Some are very shallow and disappear in very dry seasons, leaving a white alkali flat. The most striking of these lakes lie just to the east of the basin in the area of Moose Jaw-Watrous, but many are evident in the Maple Creek-Swift Current region on the southern edge of the basin.

The present drainage channels of the South Saskatchewan River system were developed by stages as the ice sheet retreated to the north and east. In terms of geological time, the river valleys are of a youthful character; that is to say, they have rather deep valleys with steep banks, and irregular gradients with periodic rapids or turbulent currents. Nowhere along its present course is there evidence of an original post-glacial valley. The new streams, which began to form channels for themselves when glacial conditions had passed away, certainly did not follow the old beds.

After the river receives the water from its many tributaries in the Rocky Mountains, it is augmented very little by local streams because of the low precipitation in the area. From source to mouth, the river drops from an altitude of over 5,000 feet to 1,500 feet at its junction with the North Saskatchewan. The river has cut down its valleys and banks very deeply and, in general, falls below the average level of the surrounding land.

The deeply trenched river valley is in general two miles wide, with banks 200 to 300 feet high. As the stream winds from one side of the valley floor to the other, it is alternately working away one bank and building up a large flat on the other. This has created the relatively steep cliffs on one side and a broad river flat a mile or so long and up to half a mile wide on the other. Where the river debouches from one level to a lower one, it has cut a long deep trench. The marked depression cut by the river through the Coteau is particularly notable around Medicine Hat, with the banks being 500 feet high or more.

Throughout most of its length the banks of the river are mostly slumped. Badland topography has developed where these banks consist of soft shales. Beyond the Coteau and below the Elbow the banks gradually become lower, while toward the junction they are little more than sandy banks and flat areas beside the river. Many ox-bow lakes occur on the river's old channels.

Except in flood time, the river is quite shallow, varying from three to ten feet deep. The flow is greatest in June, when the glaciers are melting most rapidly and the rains fall in the foothills. Melting snow in the mountains, combined with very heavy rain of long duration in the foothills, may result in floods along the river flats.

Soils

A number of distinctive soil types cross the southern prairie provinces from Manitoba to Alberta in definite arcs of varying widths. These are:

- (1) Brown Prairie soils
- (2) Dark Brown Prairie soils
- (3) Black Dark soils
- (4) Grey Wooded soils
- (5) Transitional soils

Small areas of sand hills occur in the south central part of the watershed. The position of the watershed places it astride a number of these soil belts.

The brown prairie soils occupy 43 per cent of the whole basin or 18,240,000 acres in the central part of the basin from just east of Lethbridge to Elbow. These soils are derived from post-glacial lake deposits and have many heavy clay surface soils, though of granular structure. Natural fertility is

high and they resist drought well. Being in a region of light rainfall, there is an absence of continuous moisture between the surface soil and the ground water level, thus preventing the leaching of mineral salts.

The dark brown prairie soils occupy 27 per cent or 11,200,000 acres and run in a 60 mile arc, on the west side of the basin from Lethbridge to Drumheller and on the east side from Elbow to Saskatoon. These were developed under better moisture conditions and a heavier vegetation cover. Many series of this soil type were developed upon silty lacustrine deposits and are underlain at shallow depths by boulder clay.

The black prairie soils occupy 15 per cent or 6,400,000 acres in the northern bulge of the watershed running north from Red Deer and again through the narrow neck of the basin from Saskatoon to the Forks. These soils are among the most fertile in the whole region; decaying roots or grasses have added large quantities of humus to the soil; while absence of much moisture between the surface and watertable prevents leaching of the mineral salts. Depth ranges from ten to fifteen inches. This soil zone contains more organic matter than the other zones.

Coinciding with the foothills and the Rockies in the western part of the basin are the grey timber or grey wooded and transitional soils. These occur only along the extreme west side of the basin and cover only nine per cent or 3,520,000 acres in the watershed. They developed under a woodland vegetation. A thin leaf mould overlies a grey-leached upper horizon, typical of podsol with a shallow depth of from four to twelve inches.

Transitional soils and the rocks of the Rocky Mountain cover only three per cent or a little over 1,000,000 acres in the extreme west side of the basin.

Sand Plains

Within the watershed occur many sand hills which occupy three per cent or 1,280,000 acres of the whole basin. These deposits appear to mark the location of lakes that existed during the final retreat of the Continental glacier. Bar and sand dune formations are the result of sorting action by waves, later spread and modified by wind action. The largest area is north of the Cypress Hills in the Maple Creek-Fox Valley area. Other areas of sandy waste occur near the mouth of Miry Creek, 10 miles east from Red Deer forks, and a few scattered hills six miles north of Medicine Hat.

The above description of the soils of the watershed is somewhat generalized and excludes the marked variations which occur within the various soil belts. A more detailed description would indicate a great complexity of soils, profoundly modified by glaciation and recording the previous existence of glacial lakes, old beaches, moraines, and glacial deposits ranging in fineness from boulders and gravel to clay.

Natural Vegetation

The pattern of vegetation growth, on the southern prairies as a whole, forms like the soil belts, two concentric arcs, with the centre of the arcs being on the mid-point of the International boundary in the Province of Saskatchewan. Encircling these two belts

and extending far to the north are the north-western coniferous forests. They reach southward through the extreme western part of the watershed. Far to the north this type of vegetation merges with the sub-arctic forests.

The wider arc which lies further south contains what is designated as the short grass prairies. It covers the bulk of the watershed area, 66 per cent or 43,000 square miles. Low moisture conditions have resulted in a sparse vegetation cover, consisting of the short grass species. Such species as blue grama grass, June grass and spear grass are common. The whole area is almost devoid of trees except fringes along many of the rivers and lakes.

Further north lies the area of tall grass prairies, often referred to as the Park Belt. This belt enters the watershed along the line of the western-most foothills, and again at the narrow neck of the watershed. Within the basin are 13,000 square miles, making up 20 per cent of the watershed area. The dominant vegetation cover in this belt is the tall grass species and the aspen and poplar woodland growth. Such tall grass species as northern wheat grass and rough fescue, brome grass and reed grass, thrive under the better moisture conditions. The woodland growth within the Park Belt occurs on bluffs interspersed throughout the area. Such trees as aspen, black poplar, Saskatoon berry and various willows are common.

The northwestern coniferous forest zone occupies 9,500 square miles or 14 per cent of the drainage area, in an area 60 miles wide in the extreme west of the drainage basin and coincides with the eastern slopes of the

Rocky Mountains. The dominant trees are poplar, spruce, jack pine, tamarack, willows and canoe birch.

Climate

The location of the Canadian prairies in the interior of a large continent does not allow much variety of climate. The north-south direction of the high mountains along the Pacific coast results in relatively little of the heavy rainfall reaching far inland. The relatively uniform nature of the topography on the prairies makes for a comparatively uniform climate throughout its length and breadth. However, such differences of climate as do exist, from south to north and from east to west, have had considerable influence on natural vegetation and in turn on the soils under which they developed.

Around Medicine Hat is one of the driest districts of Canada, for the total rainfall is only 12.75 inches. Towards the north part of the watershed, near Red Deer and Saskatoon, the precipitation varies from 14 inches to 20 inches and is distinctly wetter than the short grass area to the south. Such trees as poplar and some maple and ash grow under the better rainfall regime and the native grasses are of the tall grass species. The precipitation falls during the growing season; the rainy period being June in the south and gradually advancing to July in the north. The watershed area between Lethbridge and Swift Current has less than nine inches of summer rainfall.

Rainfall deficiency is perhaps the most important single fact confronting the farmers on the Canadian plains. In most years, the rainfall is deficient only in the sense that it

is not adequate except for drought resisting crops on land tilled by moisture-conserving methods. In the South Saskatchewan watershed area, moisture supply depends as much on the rate of evaporation as on the rate of precipitation. Again, effectiveness of precipitation in this area depends on the amount which falls during the growing season. Climatic information is customarily stated in terms of averages and normals. In the South Saskatchewan area the normal occurrence of rain is less important than the departures from normal. For example, at Medicine Hat the range of precipitation is from a low of 6.38 inches to a high of 25.28 inches. Here the range is 147 per cent of the average—as compared with about 16 per cent in parts of the St. Lawrence Valley. As W. J. Waines points out “over a considerable portion of the area in 40 to 60 per cent of the years, warm-season rainfall is below the minimum necessary for successful agriculture”. The agricultural economy in this area, therefore, is focussed on the conservation of moisture.

The whole basin has 120 frost free days and is well south of the 32° F. isotherm, marking the average annual temperature. The average temperature in December, January and February, the coldest months, is 10° above zero, and in June, July and August, 65°. In the summer, days are hot, running as high as 90°, but the nights are for the most part cool.

The river freezes over towards the end of October and the ice breaks up near the end of April. This period corresponds closely to the time when the winter snow is lying on the ground.

Summary

The South Saskatchewan watershed is the outstanding geographical feature of the southern Canadian prairies. Its southernmost location, as part of the larger drainage system of the Saskatchewan River, gives rise to certain physical differences between it and the North Branch. However, looking at the drainage area of the South Saskatchewan as a unit in itself, physical conditions are surprisingly uniform, in spite of its considerable extent.

In general, the physical conditions within the watershed are those of horizontal geological structure, level relief with average elevations of 2,500 feet above sea level, soils formed on glacial material and under a natural vegetation cover of short grass, deeply cut river valleys, and semi-arid to sub-humid climatic conditions. These are the factors which make up the physical pattern within the basin and give it a characteristically uniform nature throughout.

Three geographical facts are outstanding in the South Saskatchewan watershed. They are: the rainfall deficiency throughout most of the area; the constant sources of the river in the glacier fields of the mountains; and the relatively level nature of the relief.

From the point of view of physical geography these factors represent, when considered together in their various inter-relationships, the principal physical basis of the watershed area.

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Some Present and Potential River Uses²

White men first used the Saskatchewan River and its tributaries some hundreds of years ago—as a transportation route. But

it was only about fifty-five years ago that attention was given to development of its waters in other beneficial ways. The first

² This section is based on "Full Development Possibilities in the Saskatchewan River Basin", prepared

for the Commission by the Hydrology Division, P.F.R.A., Regina, Sask.

major irrigation project was started in 1901, while the first major hydro-electric plant was built in 1911. Earlier irrigation and hydro-power projects existed, but these were small.

Prior to 1930, the Government of Canada had control over the investigation and development of the water resources in the whole of the Saskatchewan River basin. During this period a complete hydrometric, irrigation, reclamation and water power service was carried on. The administration of water resources was handed over to the provinces in 1930.

Uses of Water: The demand for water is the summation of the quantities used for domestic, municipal, industrial, irrigation and other purposes. In order to ensure that legal rights to water will not exceed supply, the Provinces of Alberta, Saskatchewan and Manitoba have their respective acts governing water rights which regulate the use of water and set out definite priorities for the various types of uses.

PROVINCIAL PRIORITIES GIVEN TO
VARIOUS WATER USES

Order of Precedence	Alberta	Saskatchewan	Manitoba
1	Domestic	Domestic	Domestic
2	Municipal	Municipal	Municipal
3	Industrial	Industrial	Industrial
4	Irrigation	Irrigation	Irrigation
5	Water	Other like	Other
6	power	purposes	purposes
6	Other	Mineral	
	purposes	water	
		purposes	
7	.....	Mineral	
		recovery	
		purposes	

The need for domestic water has steadily increased with population growth and the evolution of agricultural practices. The relationship between domestic use and population growth is obvious. The relationship between domestic use and changes in agricultural practices may require some explanation. As settlement increased and agriculture became more intense, more intensive use was made of grazing lands, requiring conveniently located stock-watering pools. As a result, farm ponds, dugouts and stockwatering dams have been constructed in great numbers. Although the number of these projects is large, the consumptive use of water is far less than that used for municipal, irrigation, industrial or other purposes. The use of water for municipal purposes is a direct function of urban population. Effective consumption is about 20 gallons per day per capita. Assuming an urban population of 500,000 served by the South Saskatchewan River and its tributaries, this amounts to a demand of 20 c.f.s., which is relatively small. However, stream sanitation demands a much larger flow to maintain proper dilution of sewage and industrial wastes in order that domestic and municipal water rights may be protected.

The principal consumptive demand for industrial water on the prairies is for the production of steam power (both railway plant and central generating stations). Railway requirements for steam locomotives and roundhouse boilers are met largely by small reservoirs located on tributary streams in the basin.

Irrigation is now, and will be in the future, the largest consumer of water in the South Saskatchewan basin. The greater part of

the settled prairie region receives less rainfall than is required for the continuous production of crops. "Dry farming" has been successfully adapted to the heavier soils in the region, but many of the lighter soils are either used for marginal or sub-marginal dry farming or for grazing livestock. Many of these light soil areas produce excellently under irrigation.

Water requirements for irrigated tracts vary from soil to soil and from area to area because of physical soil properties and climate. The type of crop grown also influences the requirement or "duty" of water required for the area. However, 18 inches is generally taken as the depth of water required for the production of most crops under irrigation on the prairies. This does not include seepage, evaporation and other losses.

The production of hydro-electric power does not ordinarily require consumptive use of water except for very minor evaporation loss. The effect of hydro development on a stream is to increase stream flow during peak power loads, and to decrease stream flow (through storage) during low power loads. Since peak power loads occur during the winter, peak stream flow (other than spillway discharge) occurs at this time. Such waters can be utilized for irrigation only through additional storage. However, fairly constant summer power loads help to maintain a good summer flow which is of considerable value to irrigation development.

Other purposes include uses such as the creation of reservoirs for recreation, wild life, migratory fowl, mineral water purposes,

mineral recovery purposes, etc. The use of water for mineral recovery purposes has not amounted to a great deal to date, but it may in the future. The recovery of potash, maintenance of oil field pressures and recovery of sodium chloride and other soluble salts from deep wells is assuming more importance in the West. However, the total future use will probably be small compared with other demands and may be supplied largely from local and ground water.

The question of protection of "navigable waters" should probably be discussed as one of the "other uses". There exists a Federal Act respecting the Protection of Navigable Waters which contains regulations dealing with construction of works, disposal of wastes, etc., insofar as they affect a navigable stream or other bodies of water. However, the Act does not define "navigable waters". At present, navigation is confined to a short stretch of the Saskatchewan River extending upstream from The Pas. Log driving and shipping of sawn lumber by barge are the only industries which are using the river as a "navigable one".

This river system may be separated into six natural geographic regions as follows: the mountain and foothill area, the western prairies, the central prairies, the delta area, the lakes region and the Nelson River itself. An outline of the potentialities of the Saskatchewan-Nelson River Basin must await a full examination into the needs and interests of each region, an analysis into the compatibility or otherwise of these needs, and a comprehensive study of integration on a complete watershed basis. In the follow-

ing description of existing projects, a brief indication of the most reasonable proposals for future development has been included.

Mountain and foothill region

This first region consists of the eastern slopes of the Rocky Mountains in Alberta and Montana. While this portion of the basin is not the largest in area, it supplies, particularly in dry years, the major portion of the runoff. In the mountains the streams have a slope of from 20 to 100 feet per mile while in the foothills the slope ranges from five feet to 20 feet. There is relatively abundant water in this region for local developments. The land form ranges from steep to hilly to rolling and is generally well forested. Forest conservation, hydro-electric power generation and storage now exist and will probably remain the primary developments in this region.

Forest protection and use in this region in Canada are undertaken by two different agencies. First is the Department of Resources and Development which administers the three national parks (Jasper, Banff and Waterton Lakes) located in this area. The second agency is the Eastern Rockies Forest Conservation Board—a Dominion-Provincial body which administers the former Rocky Mountains Forest Reserve.

Hydro-electric developments are confined to Calgary Power Ltd's developments in the headwaters of the Bow River, except for one or two other very small plants of less than 500 H.P.

EXISTING HYDROPLANTS IN THE MOUNTAIN AND FOOTHILL REGION

Hydroplant	Year built	H.P. Capacity
Horseshoe Falls.....	1911	20,000
Kananaskis Falls.....	1913	24,000
Ghost.....	1929	37,450
Cascade.....	1942	23,000
Barrier.....	1948	16,000
Spray.....	1951	62,000
Three Sisters.....	1951	3,600
Rundle.....	1951	23,000

Headwater storage is provided by Calgary Power Ltd. for its system as follows:

EXISTING STORAGE IN THE MOUNTAIN AND FOOTHILL REGION

Storage development	Year built	Storage capacity ac. ft.
Lake Minnewanka.....	1912	44,000
	1942	180,000*
Ghost.....	1929	75,000
Upper Kananaskis L.....	1932	40,000
	1942	100,000*
Barrier.....	1948	29,000
Spray Lake.....	1951	210,000

* Final.

These are the only major storage reservoirs in this area except for the City of Calgary's Glenmore Dam on the Elbow River storing 20,000 acre-feet.

Irrigation in this region is limited to five small projects in the extreme southwest corner of Alberta. Water is supplied from the Belly, Waterton and Oldman Rivers.

EXISTING IRRIGATION IN THE MOUNTAIN
AND FOOTHILL REGION

Project	Year started	Irrigated acres	
		Now	Ultimate
United Irr. District.....	1921	21,000	34,000
Mountain View Irr.....	1925	3,600	3,600
Leavitt Irr. D.....	1943	2,500	4,400
Aetna Irr. D.....	1945	50	7,300
MacLeod Irr. D.....	1948	500	10,000

There is no navigation in this area. Some of these streams, however, are used for driving logs, but in terms of river use, this is negligible.

With the recent completion of the St. Mary Dam, Canada is now in a position to utilize its share of the St. Mary River which rises in the U.S.A. and is the most southerly tributary of the Saskatchewan River. Water of the Belly River not required for the four local existing irrigation projects (United, Mountain View, Leavitt and Aetna) will be utilized for irrigation on the St. Mary-Milk River Development (S.M.M.R.D.).

In a similar manner, all the water in the Waterton River, upstream from the point of diversion, will be used on the S.M.M.R.D. For this purpose, it is proposed to construct a storage reservoir having a capacity of 130,000 acre-feet just downstream from Waterton Lake.

³ Works for the Little Bow Irrigation District were constructed in 1923 at a cost of \$37,000 to divert a small flow from the Highwood River to the Little Bow River near the town of High River, Alberta. Thirty farmers along the stream obligated themselves to construct their own works and to purchase the necessary pumping equipment. The irrigable area was about 3,000 acres. After the diversion was made, little interest was shown

The low and ordinary flows of the unregulated Oldman River and its tributaries are now almost fully utilized for the existing irrigation projects downstream. Further expansion of irrigation in this tributary basin must await construction of upstream storage reservoirs. Feasible reservoir sites are tabulated below. If and when this stream does become regulated, a number of additional possible water power sites may then become of economic value; except that here, as elsewhere, hydro-electric developments could conflict with irrigation.

The upper reaches of the Highwood River and its tributaries are not used at present, and there are no natural reservoir sites in its upper basin. Until recently this stream was partially diverted into the Little Bow River to service the Little Bow Irrigation District, but as this district was abandoned in 1950, future diversions should be small.³

The headwaters of the Bow River, although well developed at present, are not yet utilized to their fullest extent. Co-ordination of power and irrigation interests on this stream may be desirable in connection with the uses of storage reservoirs. There are several run-of-the-river hydroplants still to be built that would not interfere at all with irrigation.

There are several potential headwater sites in the Red Deer basin which might some day

by the 30 farmers in building the pumping schemes, although the live stream was used for domestic and stockwatering purposes by about 100 farmers along its course. This continued until the organized district was abandoned in 1950, and since then the Alberta government has assumed responsibility for maintaining the diversion.

be used for storage. Here again, as in the Highwood basin, the practicability of operating these for joint irrigation and power purposes remains to be determined.

There is one good site for a storage reservoir in the Clearwater basin. It could prove valuable to assist future irrigation expansion.

additional potential value if and when water is diverted from this stream for irrigation purposes.

The preceding list of potential storage sites in the headwaters of the Saskatchewan River basin indicates there is good reason to hope that the variable flows of the main tributaries may some day be regulated. This

POTENTIAL DAMS AND RESERVOIRS IN MOUNTAIN AND FOOTHILL REGION

Tributary basin	Site	Storage ac. ft.	24-hour capacity H.P.	Purpose
Waterton.....	Waterton.....	130,000	.....	Irr. stor.
Oldman.....	Castle River Canyon.....	40,000	?	" " and power
"	Castle River.....	30,000	?	" " "
"	Oldman Gap.....	90,000	?	" " "
"	Willow Cr-Pinepound.....	26,000	?	" " "
Bow.....	Lac des Arcs.....	500,000	12,000	" " "
"	Russell.....	50,000	29,000	Power
"	Radnor.....	7,000	13,000	"
"	Glenbow.....	25,000	21,000	"
"	Bearspaw.....	20,000	12,000	"
"	Lower Kananaskis.....	90,000	.....	"
"	Pocaterre Cr.....	.....	?	"
Red Deer.....	Douglas Lake.....	60,000	.....	Irr. stor.
"	Red Deer No. 1.....	140,000	.....	" "
"	Red Deer No. 2.....	20,000	.....	" "
Clearwater.....	Clearwater Gap.....	160,000	.....	" "
North Sask.....	Glacier-Waterfowl.....	70,000	.....	Irr. and power st.
" "	North Sask. Gap.....	1,000,000	?	" " "
" "	Whirlpool.....	250,000	8,000	Power
" "	Terishishner.....	200,000	10,000	"
" "	Cardinal R.....	75,000	8,000	"
" "	Nordegg.....	40,000	4,000	"
" "	Rocky Rapids.....	300,000	20,000	"
" "	Carvel.....	400,000	20,000	"

The upper reaches of the Brazeau and North Saskatchewan basins offer several sites for storage developments. These could be used for power production, while those upstream from Rocky Mountain House have

hope, however, must be tempered by the following four factors:

Firstly, hydro-electric storage developments may need to be co-ordinated with irrigation developments. Irrigation interests

desire water only in the summer; power interests require the use of less water in the summer and more in the winter. This conflict of interests could conceivably delay or obstruct the development of these headwater storage sites.

Secondly, for foundation and water supply reasons, it appears likely that after the upper Bow River is fully developed, the next basin to be built up into a power stream will be the Athabaska—completely outside the Saskatchewan River basin.

Thirdly, thermal-electric plants utilizing natural gas or strip coal may tend to become competitive with the more expensive hydro-electric sites in this region.

Fourthly, the National Parks Bureau of Canada, which administers the National Parks, discourages the construction of dams and reservoirs within Banff and Jasper National Parks. The full use of these streams will require a more liberal policy with respect to applications for the diversion and use of these waters.

Western Prairie Region

East of the foothills is the western prairie region lying generally in central Alberta. It is characterized by moderate river gradients, river banks usually 100 feet or more in height, a semi-arid climate and generally flat to rolling topography. This combination has allowed the development of gravity irrigation in those locations having good irrigation soils.

Irrigation developments are by far the most important uses of water in this region.

EXISTING IRRIGATION IN THE WESTERN PRAIRIE REGION

Project	Year started	Irrigated acres	
		Now	Ultimate
St. Mary-Milk River Project...	1901	150,000	495,000
Western Irrigation District...	1908	50,000	50,000
Eastern Irrigation District...	1914	200,000	281,000
Lethbridge Northern Irrigation District.....	1922	75,000	96,000
Bow River Irrigation District (C.L. and I. Co.).....	1918	50,000	240,000
Small private projects.....		50,000?	70,000

EXISTING MAJOR STORAGE IN IRRIGATION PROJECTS

Irrigation Project	Reservoir	Capacity in acre feet	
		Now	Ultimate
St. M.M.R.D.....	St. Mary reservoir...	270,000	270,000
"	Chin.....	50,000	150,000
"	East Pothole.....	14,000	14,000
"	Ridge.....		80,000
"	Verdigris.....		110,000
"	Waterton.....		130,000
Eastern I.D.....	Lake Newell.....	90,000	100,000
Bow R. I.D.....	Lake McGregor.....	75,000	200,000
"	Traverse.....		20,000
"	Little Bow.....	20,000	20,000
Leth. Nor. I. D...	Keho Lake.....	40,000	40,000

It should be noted that these irrigation projects are limited to the southern tributaries of the Saskatchewan River. No major irrigation developments as yet exist north of the Red Deer River.

No hydroplants exist in this region, although at one time there was a 700 H.P. plant near Calgary and another of 180 H.P. installed in the C.P.R.'s bassano Dam. These have proved to be uneconomical. Industrial uses, especially on the North Saskatchewan River near Edmonton, are becoming increasingly important due to industrial growth.

Of the existing large irrigation projects, only the Western Irrigation District is fully

developed. The other projects are steadily expanding towards their full authorized development. When this occurs, practically all but the winter and flood flows will be completely utilized in the whole of the Bow and Oldman River basins (i.e. upstream from Medicine Hat). This indicates that no further major irrigation projects can be initiated in this region on or south of the Bow River. Of course, there are possibilities of developing some new small irrigation projects where the local water supply is sufficient.

This leaves the Red Deer and North Saskatchewan basins with potentialities for large irrigation development in this region.

It is unlikely that the North Saskatchewan basin will ever need large-scale irrigation within its drainage area—its climate appears satisfactory for successful dry land farming.

On the other hand, large areas in the Red Deer basin are suitable for irrigation. Present plans call for a high dam on this river near Ardley to store and divert irrigation water and produce supplementary hydro-electric energy. Red Deer River water alone could only irrigate 300,000 acres and produce 5,000,000 k.w.h. annually, or alternatively, irrigate 100,000 acres and produce 35,000,000 k.w.h. annually. An additional 200,000 acres could be irrigated if the summer flows of the Clearwater River were diverted into the Red Deer River. A further 300,000 to 400,000 acres could be irrigated if North Saskatchewan water were diverted into the Red Deer River utilizing, in part, the Clearwater diversion route. Thus, there is sufficient water available to irrigate over 600,000 acres of land in the Red Deer and adjoining basins providing (a) there are sufficient good

irrigable lands to utilize this amount, (b) there is sufficient storage available to regulate this water, and (c) that trans-basin diversions meet with no opposition.

With regard to point (a): the upper Sounding Creek-Berry Creek area of this region probably contains about 300,000 irrigable acres. This area is known as the proposed Red Deer Irrigation Project. It is believed that an extension of the main canal, crossing into Saskatchewan near the town of Loverna, could serve an additional 200,000 acres in the central prairie region. It therefore appears that 500,000 acres is the maximum acreage that could be irrigated without running the canals an excessive distance with corresponding excessive losses. It should be pointed out, however, that very little information is available on this proposal. To irrigate these 500,000 acres it would only be necessary to divert the Clearwater River without further diversion from the North Saskatchewan. This would mean that only a relatively small amount of hydro-electric energy could be developed at the Ardley Dam.

With regard to (b): there are sufficient potential storage sites to regulate the water for the purposes of this project. These are, in addition to the potential sites in the mountain and foothill region enumerated previously, as follows:

Name of Site	Capacity acre-feet	Purpose
Raven.....	150,000	Irrigation storage and power
Ardley.....	300,000	" "
Buffalo Lake.....	300,000	Irrigation storage
Craig and Hamilton...	250,000	" "
Grenville.....	250,000	" "

Throughout this region there are some small potential irrigation projects not already mentioned.

Tributary Basin	Project name	Irrigable acres
Oldman.....	Todd Creek.....	8,500
"	Pincher Creek.....	16,000
"	Beaver Creek.....	2,500
"	Cowley.....	3,000
"	Granum.....	4,500
"	Carmangay.....	12,000
Highwood.....	Champion.....	50,000

Of these potential irrigation projects, it is probable that, at the most, only 40,000 acres would ever be developed because of various climate, soil, water supply or economic factors.

There are other schemes on the two tributaries rising in the Cypress Hills, but these are small and, for the purpose of this review, negligible.

Central prairie region

In this region, the major Saskatchewan River tributaries flow through deep valleys and have relatively flat gradients. In the middle of the region (South Saskatchewan Development area) the climate, soil and topography are practically identical with those of the western region. The deep river valleys make it impracticable to construct high dams for gravity irrigation alone or for the development of hydro-electric power alone. Where, however, it is possible to combine these two uses, the development may

become desirable. In such a case, the deep valleys and flat gradients would provide a very large amount of storage.

Farther downstream, the North and South Saskatchewan Rivers and the Saskatchewan River become steeper with some rapids. Hydro-electric power projects, even if aided by upstream regulation, are marginal in these stretches of the rivers.

Irrigation on the main rivers has not developed as yet. However, some irrigation does exist on the tributaries and on the river flats. The Qu'Appelle River valley, which lies adjacent to the South Saskatchewan watershed, offers possibilities for the development of water for a variety of important uses. The Qu'Appelle River has its source near the South Saskatchewan River, at the town of Elbow. It runs in an easterly direction for some 250 miles, joining the Assiniboine River approximately 10 miles east of the Manitoba-Saskatchewan boundary. Throughout most of its length the valley bottom is broad and flat, and large areas are suitable for agricultural purposes. Because of the flat gradient, the river has formed six large lakes in the valley.

At present approximately 40 per cent of the land in the Qu'Appelle Valley is under cultivation, the major part of which is in ordinary field crops. Irrigation on a small scale is practiced by some market gardeners near the town of Craven.

Future demands on the water of the Qu'Appelle River will be from three sources: (1) use of Buffalo Pound Lake by the cities of Regina and Moose Jaw for domestic water supplies; (2) further irrigation of the valley flats; and (3) maintenance of the lake levels for water supplies and recreation.

The Qu'Appelle River itself does not have sufficient water to meet these demands, and for future developments it will be necessary to obtain water from an outside source. The South Saskatchewan River is the only practical source from which to obtain this additional water.

One method of delivering water to the valley is through works of the proposed South Saskatchewan River Project. Here the water could be released from the Meridian Dam to flow by gravity the 20 miles to Buffalo Pound Lake. A second method is by pumping at "the Elbow" on the South Saskatchewan River, and delivering the water by 52 miles of canals and natural channels to Buffalo Pound Lake.

It is estimated that by the year 1980, the combined population of the cities of Regina and Moose Jaw will have reached 130,000 persons. In this year these cities will be drawing the major portion of their domestic water supplies from Buffalo Pound Lake. Natural runoff will provide only part of this demand of possibly 10 million gallons daily. Water supply studies indicate that in an average year 18,500 acre feet of water will have to be obtained from the South Saskatchewan River to augment natural supplies. This demand would reach a peak of 33,000 acre-feet during a year of low runoff.

There are about 30,000 acres of land in the valley which are suitable for irrigation. The inflow below Buffalo Pound Lake is sufficient to irrigate only 6,000 acres. Water from the South Saskatchewan River would be required for the remaining 24,000 acres. This average annual requirement will be 23,000 acre-feet and the maximum requirement 27,500 acre-feet in any one year.

The Qu'Appelle Lakes in the vicinity of, and downstream from, Fort Qu'Appelle will be kept full by the irrigation water passing through them. Last Mountain Lake, is therefore, the only lake requiring further water for maintaining the water level.

Last Mountain Lake levels have ranged from a low elevation of 1598 to a high of 1612. By adding 25,000 acre-feet annually from the South Saskatchewan River in average and low-water years it would be possible to prevent this lake from falling below elevation 1605. No water would be required in wet years.

Summarizing these results, it can be seen that in order to have sufficient water in the Qu'Appelle watershed to meet demands for municipal water supply, and irrigation and maintenance of lake levels, an average of 66,500 acre-feet of water annually, and a maximum of 85,500 acre-feet will have to be obtained from the South Saskatchewan River to supplement the natural flow of the Qu'Appelle River.

A pumping plant and delivery canal with a capacity of 220 c.f.s. will supply the required water from the South Saskatchewan River. The works will have to be operated continuously for an average of 5 months each year. During a year of low runoff the works will have to be operated 6½ months.

It is estimated that a pumping plant and delivery canal of this magnitude will cost \$1,500,000 to construct, while the average annual operation, maintenance and depreciation charges will be \$200,000 each year. These amounts do not include the cost of developing irrigation in the valley, but are

the cost of stabilizing the water supply with water from the South Saskatchewan River by the pumping method.

EXISTING IRRIGATION
IN THE CENTRAL PRAIRIE REGION

Project	Year	Irrigated acres	
		Now	Ultimate
Swift Current Irr. Dis.....	1940	7,500	21,000
French Flats—Valley Park...	1949	700	6,500
Small private projects.....		4,000	8,000

In 1912, construction of La Colle Falls hydro-electric plant on the North Saskatchewan was started but never finished. It is now abandoned. It is unlikely that further hydro developments will ever be initiated on this stretch of the river. Irrigation from the North Saskatchewan River is also unlikely because (1) dryland farming is fairly successful in the immediate area, and (2) high pumping lifts would be required from the river. The future use of the *North Saskatchewan River* will include in addition to the possible Clearwater diversion, municipal and industrial uses near Edmonton and some very minor irrigation schemes, and possible hydro-electric developments on the head waters.

POTENTIAL HYDROPLANTS
IN THE CENTRAL PRAIRIE REGION

Basin	Name	Installed capacity K.W.	Storage Acre-feet
South Sask.....	South Sask. R.P.....	150,000	3,900,000
" "	Batoche.....	40,000	
" "	Coxby.....	40,000	
Saskatchewan..	Fort à la Corne.....	100,000	230,000
" ..	Nipawin.....	100,000	230,000
" ..	Squaw.....	50,000	

POTENTIAL IRRIGATION
IN THE CENTRAL PRAIRIE REGION

Project	Irrigable Acres
Swift Current extension.....	14,000
Red Deer extension.....	200,000
South Saskatchewan R.P.....	450,000

Other uses of water in this region will be small. Additional major irrigation developments are possible but improbable.

Delta area

Between the prairie and lake regions, the Saskatchewan River flows through a broad flat valley which is generally lightly wooded, but which is dotted with numerous shallow lakes and large open marshes. The soil, being built up through the years by silt deposition, is very rich. With reclamation, this area may have excellent agricultural possibilities. Navigation and log-driving, upstream from The Pas, are present.

In 1940, the rehabilitation of muskrat breeding grounds, dependent on annual flooding from the Saskatchewan River, was encouraged. This type of development, however, is being gradually supplanted and destroyed by the more desirable and increasing uses that are being made of the rich delta soils for agricultural purposes.

There is no prospect for either irrigation or hydro-electric developments in this region. Water transportation and log driving will continue to use the river without interference from artificial controls. The higher lands west of The Pas are being increasingly

occupied for agricultural purposes. The possibility of reclaiming the lower-lying lands was first surveyed in 1911 and is presently being investigated.

The delta is situated in the vicinity of the Saskatchewan-Manitoba boundary. It is bounded by Cumberland Lake and the Saskatchewan River on the north, the Carrot and Pasquia Rivers on the south, and extends westerly from The Pas, Manitoba, a distance of 85 miles. Most of the land is low-lying and marshy, with the general elevation of the area about that of the summer water levels in the bordering rivers. There is a gentle slope from about elevation 900 at the western end to 850 at The Pas. Generally, the river banks are relatively high and support a heavy mixed forest growth. Inland, the land drops away and the forest gives way to willows, and open grass land and marsh occupy about 80 per cent of the 4,000,000-acre area.

The low-lying nature of the land and poorly developed drainage confine the present land use mainly to lumbering and trapping. Works for flooding much of the area have been built by the Government of Manitoba, the Hudson's Bay Company, and the Indian Affairs Branch for the purpose of increasing the muskrat population. Periodically the Saskatchewan River overflows its banks from near Cumberland House on Cumberland Lake, to The Pas, inundating. Alternative to diverting the Pasquia River would with the poorly developed drainage, has resulted in most of this fertile land becoming marshy and unfit for cultivation.

About 1,000 acres of the higher lands along the Pasquia and Carrot Rivers are patented lands, and have been cultivated successfully

for many years. In recent years, settlers have leased and broken some 15,000 acres of additional land, and where water levels permit, cattle are grazed on the uncultivated area.

As early as 1915 investigations had been made of the Saskatchewan delta region to determine the feasibility of reclaiming the area by protective dyking and drainage. In more recent years soil surveys and economic studies have been done of some sections of the region.

The preliminary survey of that area of the delta which lies between the Carrot and Pasquia Rivers, and extends from The Pas to the Saskatchewan-Manitoba boundary, has been completed. This tract is known as the Pasquia area, and being separated from the remainder of the delta by the Carrot River, can be reclaimed independently of the region as a whole. The Pasquia area contains about 135,000 acres of which 16,000 are now being cultivated, and about 5,000 more used for hay and grazing.

The P.F.R.A. surveys and engineering studies of the Pasquia area show that the construction of 22 miles of dyke, with a maximum height of eight feet, and diversion of the Pasquia River into the Carrot River near the Saskatchewan-Manitoba boundary, will prevent further flooding. An alternative to diverting the Pasquia River would be the construction of an additional 30 miles of dyke along its west and north banks.

Drainage of part of the area can be accomplished by open ditch drains and pumping stations. The remainder of the area can be drained into lake storage during the high water periods; this storage would be released every fall when the river is normally low.

If flood protection and drainage is provided, an estimated 96,000 acres will be suited for cultivation and an additional 10,000 acres to hay and grazing uses.

The cost of the works necessary to reclaim the land in this area has been estimated by the engineers carrying on the present investigation at \$1,350,000, or about \$13.50 per acre. No recent estimate of cost has been made for reclaiming the remainder of the Saskatchewan Delta Region.

At present easily accessible and under-supplied markets are available at The Pas and Flin Flon, a relatively short distance from the source of supply. With the development of marketing facilities and improvements in transportation, this market might absorb the produce during the initial stages of development.

To the east of The Pas the river flows through more marshland. The reclamation of this area, from The Pas to Cedar Lake, can be accomplished by lowering Cedar Lake by improving its outlet, by further river channel improvement and by the construction of levees and interior drains. This would reclaim at least an additional 500,000 acres. This proposal, however, is expensive and would be in conflict with the proposed Dauphin River power project.

At one time there was a proposal to build an hydro-electric plant, having a head of 80 feet, just at the mouth of the Saskatchewan River at Grand Rapids. This plant may never be built as it is in direct conflict with both the Dauphin River power project and the reclamation project east of The Pas.

It is possible to divert the Churchill River to the Saskatchewan River via the Sturgeon-weir River. It remains only a possibility.

The Lakes Region

The lowest reaches of the Saskatchewan River pass through and empty into large fresh water lakes that are the remnants of glacial Lake Agassiz. In addition to the obvious uses of logging, navigation, fishing and recreation, the lake system can, by various diversions, be developed for hydro-electric power production.

This is proposed in the Dauphin River Power Project. By constructing a series of canals, dykes, dams and river improvement works, this project can develop about 800,000,000 k.w.h. of annual firm electrical energy near the mouth of the Dauphin River on the western shore of Lake Winnipeg.

There remains the question of whether it would be more economical to build this project or develop the hydro sites on the Nelson River. If it is found that the Nelson River sites are more desirable, then this Dauphin River Power Project would be, for the foreseeable future anyway, abandoned.

The Nelson River

This river, the outlet of Lake Winnipeg, drains some 450,000 square miles including the Saskatchewan River Basin. The river is entirely unused except for an insignificant amount of summer seasonal traffic.

In its course to Hudson Bay, it falls about 700 feet, of which 550 feet are considered useful for power purposes. Allowing for three feet of useful storage on Lake Winnipeg, the dependable flow has been estimated to be over 44,000 c.f.s.

From 10 to 15 separate hydroplants will be required to utilize the 550 feet of effective

head, two of which are now under active investigation. These are, (1) Whiskey Jack with a head of 30 feet, and (2) Whitemud Falls with a head of 50 feet.

The only deterrent to the development of this river is the considerable distance between the power plants and markets which give rise to high transmission costs and electrical losses.

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The Historical Setting

I. National Policy and Western Canadian Development

TWO SETS of circumstances provide the essential background for a review of the economic development of the South Saskatchewan watershed. The first of these is political and economic and can be analysed under the heading of national policy. The second is geographic and concerns the relationship between the South Saskatchewan River basin and the interior continental plain. Both sets of circumstances will be examined with a view to a realistic description of economic development in the prairie provinces.

1. *Formulation of the National Policy.*—The terms of reference require the Commission to inquire whether the South Saskatchewan River Project would justify the costs which it would entail and whether it would represent the most profitable and desirable use which could be made of the necessary physical resources. The question at issue is clearly the advisability or otherwise of a substantial developmental expenditure on the part of the federal and certain of the provincial governments of Canada. Such a question cannot be considered adequately in an historical vacuum. If the prairie areas of Canada have been developed to the present time solely on the strength of private

enterprise unsupported by state resources, then it is obvious that the proposals now under consideration relating to the South Saskatchewan River mark a radical departure from tried and accepted experience. If, however, governmental finance and guarantee have been the constant companion of private venture capital in the development of the West, it follows that the proposals being examined by this Commission involve no departure from Canadian usage, and the merit or lack of merit of such proposals must therefore be assessed with that in mind. The latter has, in fact, been true. Western economic expansion has proceeded to date within the framework of national developmental policy which evolved gradually after the middle of the nineteenth century. This policy has rested on the assumption that one of the main functions of the public treasury was to underwrite developmental projects which were regarded as essential in the national interest but from which the monetary returns appeared so remote or so uncertain as to prove unattractive to private capital.

When Canadians speak of the "National Policy" they have in mind the protective tariff system introduced by the Conservative government in 1879. At some loss to discover an issue on which to oppose the Liberals in the elections of 1878, Macdonald

This chapter was prepared for the Commission by Vernon C. Fowke, Ph.D., Department of Economics, University of Saskatchewan, Saskatoon.

adopted the proposal of providing encouragement to Canadian industry by the introduction of protective tariffs and bounties. By a stroke of genius, as Professor Underhill says, Macdonald labelled this proposal the "National Policy". Winning the election on this platform Macdonald's government implemented the National Policy of tariff protection, introduced substantial increases in existing rates immediately and raised them still further over the succeeding decade. Liberal governments which followed in power after 1896 maintained the protective system with only minor modifications in the direction of imperial preference. The protective system has been the National Policy to Canadians to the present day.

The protective system was, however, but a part of the national policy in its broadest sense and has significance only in relation to the whole. Protection was, in fact, practically the last feature of the national policy to be adopted. The concept of a national policy ante-dated Confederation. It included the federation of the British North American colonies and territories as its indispensable constitutional instrument. The other elements of this policy must be indicated in order to show their inter-relationships with particular reference to the development of the prairie west.

The national policy took shape gradually and haltingly but, nevertheless, with tremendous vision, approximately a century ago. It involved what at that time could only be described as a fantastic design for the creation of a single nation, British in allegiance, to embrace the northern half of the North American continent from coast to coast and, in addition, the islands of the East and of the West. By the late eighteen-fifties these

gigantic spaces contained approximately three million people scattered in isolated pockets from east to west, with a minimum of intercommunication and ruled by more than half a dozen distinct governing bodies. The main concentration of population was on the St. Lawrence where some two and one-half million people, divided approximately 45-55 between groups of French and English extraction, constituted the United Province of Canada. This colony had behind it two generations of representative government but less than a decade of responsible government. On and in the Atlantic were the four Maritime colonies of Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland, each with a separate colonial government in which the responsible feature was as new as on the St. Lawrence.

A thousand miles to the west of the St. Lawrence a handful of colonists clung tenaciously but insecurely to an agricultural livelihood on the river-side strip farms about Fort Garry on the Red River. Their holdings lay within the territorial and political limits of the Hudson's Bay Company. Apart from the Red River Settlement, Rupert's Land—all land drained by waters flowing into Hudson Bay—was the empty but jealously guarded fur-producing empire of the Hudson's Bay Company. On the west coast were two groups of settlers, one on Vancouver Island and one on the mainland. Here the influx of prospectors and settlers occasioned by recent gold discoveries had led to the creation of the crown colonies of Vancouver Island and British Columbia. In retrospect, those who formulated the project of creating a nation under these geographic circumstances and with these scattered fragments of population resources, are clearly

worthy of being credited with national vision, however haltingly their project may have come to fulfilment.

The project for the creation of a Canadian nation co-extensive with the northern half of North America was initiated and moulded by influential interests within the Province of Canada. It was generated and fostered partly in envious admiration of the successful, semi-continental imperialism of the United States throughout the first half of the nineteenth century, and partly out of the desperate necessity of adopting what might well appear to be a next to impossible, but the only, expedient.

Little need be said concerning the American example. After the Revolution a continuous tide of settlement moved through the passes of the Appalachian and Allegheny mountains, and, filling in the arable territories as it went, had by 1850 brought the agricultural frontier of the United States to the Mississippi Valley. Bridging rather than occupying the inhospitable—or, as they were then regarded, uninhabitable—high plains beyond the Mississippi, substantial contingents trekked under appalling hardships to the Oregon country of the west coast. Gold discoveries in California in 1848 aroused a feverish interest in the south-west coastal area. Railways reached from New York to the Mississippi via the Hudson-Mohawk river valleys by 1850 and pushed southwestwardly beyond in succeeding years. In 1862 the Union Pacific was chartered to join up with the Southern Pacific, the latter building

from the west coast, to provide the first transcontinental rail communication in the United States. In 1864 the Northern Pacific was chartered to link the Great Lakes area with Puget Sound.

It is not hard to discover the results of the tremendous agricultural expansion in the United States which called forth the envious admiration of observant Canadians. Immigrants poured into American territory and the national population increased by leaps and bounds. New states were carved out of the territories and added to the Union.¹ Construction and housing trades prospered. Western agricultural expansion led to eastern urbanization, to the growth and prosperity of commercial and industrial centres. To equip and service the agricultural frontier there was necessary a tremendous increase in the manufacturing, merchandising and transportation facilities of the country. The frontier farmer is typically a trader. He sells much and buys more, financing the difference by the accumulation of debt. Westward over the continental trade routes, over rivers and increasingly over railways, there moved the manufactured products of eastern cities. Eastward in return there moved the products of the expanding agricultural areas, cereals, livestock and livestock products. The national income and the national revenues multiplied, partly as a direct result of increased agricultural production but more particularly because of the commercial and

¹The westward advance of the American agricultural frontier can be noted in the creation of new states and their admission to the Union. Michigan was admitted in 1837, Iowa in 1846 and Wisconsin in 1848. The population of Minnesota Territory (exclusive of Indians) increased from 6,000 to 172,000 between 1850 and 1860.

Minnesota was admitted as a State of the Union in 1858. Dakota Territory was organized in 1861. In 1889 North and South Dakota, Montana and Washington were constituted states and admitted to the Union. In 1890 Wyoming and Idaho were created and admitted.

industrial employments which followed inevitably in the wake of agricultural immigration and settlement.

It is necessary for two reasons to stress the commercial attributes of agricultural immigration and settlement. In the first place the typical economic interpretation of Canadian development has consistently underestimated the commercial importance of immigration and settlement processes. Everyone "knows", in fact, that the pioneer settler was mainly self-sufficient, buying and selling practically nothing, and therefore of no possible interest to commercial or industrial groups. This characterization of the pioneer settler in Canada is far from correct. The Canadian frontiersman has typically been a substantial buyer and seller of goods and has consequently been of direct practical interest to commercial and industrial groups.

In the second place, the chief economic activities of producers on the St. Lawrence were commercial activities. This was true from the days when Europeans first penetrated the area, and it remained so throughout the pre-Confederation period despite substantial agricultural expansion. The influential groups in the Province of Canada throughout the period in which the national policy was gradually moulded into shape were commercial groups—importers and wholesalers, transportation interests including contractors as well as railway and shipping interests, commercial banks and insurance and trust companies. A manufacturing and industrial group was present in embryo and its interests were of increasing significance in the later stages of the formulation of the national policy, notably in the introduction and maintenance of protective tariffs. The points to be noted here, how-

ever, are, (1) that the economic purposes of the national policy were essentially commercial, and (2) that western agricultural development came to represent a substantial part of the objectives of the national policy, largely because of the recognized commercial attributes of large-scale agricultural immigration and settlement.

American experience throughout the first half of the nineteenth century demonstrated clearly the economic advantages of immigration and of agricultural expansion. Canadians of the pre-Confederation years, however, had no need to look even as far as across the St. Lawrence river for conclusive demonstration of the relationship between commercial profits and general prosperity on the one hand, and agricultural expansion on the other. The twenty-five or thirty year period after 1825 was one of substantial immigration to the Canadian part of the St. Lawrence region and concurrently there was accomplished the occupation of the great bulk of the agricultural lands of Upper Canada. The commercial frontier followed closely behind the agricultural frontier. The locations of cross-roads stores and post-offices and the stream and river sites of grist- and saw-mills developed into villages equipped for the exchange of farm produce for manufactured goods and for the processing of agricultural and forest raw materials. Many villages grew into towns, and some towns, favored by location or by exceptional enterprise, grew into commercial and processing cities. The commercial expansion created a demand for improved transportation facilities. The St. Lawrence was first improved by a costly system of canals during the eighteen-forties. But by the time of its completion, the canal

system was obsolescent in view of the widespread adoption of railways in the United States.

There is far more than coincidental significance to the mention of American railway development in the circumstances outlined here. American railways were of impelling importance to the prospects and projects of the Canadians in the pre-Confederation years because the construction of railways in the United States placed the competitive Canadian trade route at a disastrous disadvantage. Europeans established on the St. Lawrence and on the Hudson-Mohawk river systems had been bitter commercial rivals from the days of their first introduction to the North American continent in the early seventeenth century. For upwards of two centuries the fur trade was the chief field of profitable enterprise throughout the continent. French merchants situated at the mouth of the St. Lawrence struggled to secure the supremacy of their trading system in competition with the Dutch and later the English who traded inland from New Amsterdam (later New York) at the mouth of the Hudson. By the early nineteenth century agricultural settlement moved inland from the New England coast, enveloping the lower Great Lakes in its westward movement before moving onward toward the American Middle-West. The St. Lawrence and the Hudson-Mohawk river systems persisted as rivals for the inward and outward commerce of the agricultural frontier. The opening of the Erie Barge Canal in 1825 gave undoubted leadership to the New York interests as compared with those of Montreal. As noted above, the St. Lawrence canal system, created in the eighteen-forties, failed to restore the competitive prospects of

the St. Lawrence group because meanwhile New York had been linked with the Mississippi agricultural frontier by a railway system.

Economic expansion and general prosperity prevailed in Canada throughout the early eighteen-fifties, associated with a continuance of substantial immigration and the occupation of new agricultural lands. The Grand Trunk Railway was built through the St. Lawrence valley to link Montreal and Toronto with Sarnia on the Canadian-American boundary, and from Montreal it joined with other railways, to emerge at the ice-free American port of Portland, Maine. The expectation was that this system would enable the St. Lawrence commercial system to share in the profitable servicing and supplying activities of the American agricultural frontier.

The latter part of the eighteen-fifties was as disheartening in the Province of Canada as the early part of the decade had been promising. Immigration fell to negligible proportions. The best efforts of the provincial government to open new areas for agricultural settlement accomplished little other than to disclose the fact that little suitable land remained unoccupied in the province, so near, in fact, were the margins of the Precambrian Shield. Settlers who were induced by the offer of free land to settle in the pine forests beyond the northern margins of established farms lands, cleared and sold the timber from their land grants and moved on to the United States. The improvement of the St. Lawrence transportation facilities, first by the construction of canals and second by the construction of a railway, left private interests and public authorities saddled with a heavy burden of

debt. The debt was a dead-weight burden for the economy was stagnant. The development expenditures had not achieved their purpose. The trade of the American agricultural frontier could in no way be drawn through the St. Lawrence trade route. Montreal lagged far behind New York, and Toronto clearly possessed few of the prospects of mid-western American cities.

The preceding pages have sketched the economic circumstances within which the national policy gradually took shape after 1850. The net result of these circumstances was that the problems facing the individual colonial governments of British North America obviously exceeded the possibility of solution by independent and disunited effort. American expansive vitality might clearly rest in part upon a comparatively favourable geographic situation, but such vitality could not be wholly divorced from the existence of a national unit with free exchange of goods throughout its geographic limits and with a central government to assume the indispensable major developmental burdens and responsibilities. The eastern British American territories—the Province of Canada and the Maritime colonies—were already considerably developed, and although their economies were weak in disunity they were nevertheless complementary in character. A national union, which would wipe out the tariff walls which separated them, would do much toward the promotion of trade among them. But the difficulties of communication could only be overcome by the construction of an intercolonial railway through barren distances. This project, already mooted,

was clearly beyond the capacity of both private enterprise and governmental ability on the part of the individual colonies. A national government would be the minimum competent agency.²

2. The Western Territories and the National Policy: American Experience.—Important as were the prospects which awaited a union of the Maritime and St. Lawrence colonies after 1850, it was increasingly clear that the maximum possibilities of further economic expansion within these colonies, even on a united basis, were limited in the extreme. The prosperity and economic vitality of the eastern states of the American Republic were based on agricultural expansion far beyond the western limits of the states themselves. Prosperity for the eastern British colonies would require similar external areas for occupation and further development.

If these were the conditions of future Canadian prosperity, the geographic comparison between the Canadian and American territories was of the most discouraging kind. Where the American agricultural frontier moved steadily westward to the Mississippi through the fertile and approachable areas of the middle west, the Canadian territorial counterpart was a stretch of approximately one thousand miles of Precambrian Shield which lay along the northern shores of Lakes Huron and Superior and extended well beyond to the margins of the Red River valley. To the north of the head-waters of the Mississippi, however, the Red River valley extended across the boundary into

² The British North America Act of 1867 (Sec. 145) imposed upon the Government of Canada, newly constituted by the Act, the obligation to commence within six

months the construction of a railway from the St. Lawrence to Halifax, to construct the railway "without intermission," and to complete it "with all practicable speed."

Rupert's Land. Beyond the Mississippi and the Red River the broad continental plain stretched to the foothills of the Rocky Mountains. Gold discoveries on the Fraser in the eighteen-fifties gave some slight air of reality to the dream of a British American nation which might some day spread from the Atlantic to the Pacific, but the barriers appeared well-nigh insuperable. The Shield and Great Lakes on the East and the mountains on the West offered tremendous handicaps to settlement. There remained the uncertain quantity, the central plains between. What could be said of the nature and settlement possibilities of this area in the pre-Confederation years?

Canadians had little reliable information concerning the central plains region before the latter part of the eighteen-fifties. This was true despite the fact that the area had been traversed by fur traders for well over a century. It was recognized that that part of the plains which lay in British territory was but the northern extension of the American central plains. Contrary to Canadian experience, the Americans had a good deal of information about this area, some of it idle hearsay and some the result of painstaking and organized investigation. The American tide of settlement had reached the eastern margins of the plains before 1850. So inhospitable did this area appear to be, however, that the settlers crossed it to reach the intermountain valleys nearer to the west coast but did not attempt to settle upon it. It had long been a well accepted premise that the inadequacy of rainfall and the absence

of tree growth throughout the plains rendered them unsuitable for agricultural pursuits.

The entire plains region of the North American continent was, in fact, known as the Great American Desert. Professor Webb, an eminent present-day student of the North American plains, says that the concept of the Great American Desert is to be found in written records well back into the sixteenth century, that it was prominent in American thought from 1820 to 1858 and "was at its height in the decade between 1850 and 1860".³ He says in part: "The fiction of the Great American Desert was founded by the first explorers, was confirmed by scientific investigators and military reports, and was popularized by travelers and newspapers".⁴ Speaking of the Oregon settlers Webb says in part: "The Oregon migration, which was pretty well developed by 1843, was an example of a frontier jumping nearly two thousand miles over an unoccupied country . . ."⁵

Advanced scientific opinion of the American plains in the middle eighteen-fifties is represented by the following statement by Professor Joseph Henry, Secretary of the Smithsonian Institution. Professor Henry wrote in 1856:⁶

"The general character of the soil between the Mississippi and the Atlantic is that of great fertility . . . The portion also on the western side of the Mississippi, as far as the 98th meridian, including the States of Texas, Louisiana, Arkansas, Missouri, Iowa, and Minnesota, and portions of the territory of Kansas and Nebraska, are fertile, though abounding in prairies and subject occasionally to droughts. But the whole space to the west, between the 98th meridian and

³ Webb, W. P., *The Great Plains* (New York: 1931) p. 159.

⁴ *Ibid.*, p. 153.

⁵ *Ibid.*, p. 149.

⁶ "Meteorology in its Connection with Agriculture", *The Patent Office Record*, for 1856, as cited in H. Y. Hind, *Narrative of the Canadian Exploring Expeditions* (London, 1860) Vol. II, pp 355-7.

the Rocky Mountains, denominated the Great American Plains, is a barren waste, over which the eye may roam to the extent of the visible horizon with scarcely an object to break the monotony. . . .

"We have stated that the entire region west of the 98th degree of west longitude, with the exception of a small portion of west Texas and the narrow border along the Pacific, is a country of comparatively little value to the agriculturist; and, perhaps, it will astonish the reader if we direct his attention to the fact that this line, which passes southward from Lake Winnipeg to the Gulf of Mexico, will divide the whole surface of the United States into two nearly equal parts. This statement, when fully appreciated, will serve to dissipate some of the dreams which have been considered as realities as to the destiny of the western part of the North American continent."

In 1858 Professor H. Y. Hind of the University of Toronto published a paper on the "Great North-West" in which he summarized the results of investigations concerning the western territories of the United States. He said in part:⁷

"The exploration for the Pacific Railroad [in the United States] and the meteorological investigations carried on under the direction of the Surgeon-General (*sic*) of the U.S. Army, show conclusively that no settlement of any importance can be established over a vast extent of country, many hundreds of miles broad, on the eastern flank of the Rocky Mountains, and south of the Great Bend of the Missouri. Owing to the absence of rain, the apparently great rivers, the Platte, the Canadian, the Arkansas, etc., are often converted into long detached reaches or ponds during the summer months, and forbid extensive settlements even on their immediate banks

"The popular impression that immense areas of land, available for the purposes of agriculture, lie between the Missouri and the Rocky Mountain chain, has, as before stated, been completely refuted by the

explorations and surveys for the Pacific Railroad. The now well ascertained aridity of climate and its natural consequence, sterility of soil, both combine to confirm the title of 'The Great American Desert', given by the early explorers of the eastern flank of the Rocky Mountains to that extensive region of country"

Horace Greeley, well known as the leading American advocate of westward migration a century ago, verified and popularized the limitations of the plains area for settlement. In 1859 he crossed the American plains and published his observations in the *New York Tribune* which Professor Webb describes as "the most influential paper in the United States (at that time)."⁸ Among Greeley's comments, for example, was the following: "The plains are nearly destitute of human inhabitants. Aside from the buffalo range . . . (this region) affords little sustenance and less shelter to man . . . Wood and water—the prime necessities of the traveller as of the settler— at length they gradually fail, and we are in a desert indeed."⁹

3. *Settlement Prospects in the Canadian West.* American investigations, however, were concerned primarily if not exclusively with the territory to the south of the boundary, that is, below the 49th parallel of latitude. Professor Henry noted that the 98th meridian, west of which he said the "entire region . . . is a country of comparatively little value to the agriculturist", passed southward from Lake Winnipeg to

⁷ Hind, *Narrative of the Canadian Exploring Expeditions*, Vol. II, App. VII, pp. 410-13. A few years later Captain Palliser commented on the American investigations of the plains area of the continent and concluded that, "No one of these surveys, however, offers a favorable prospect for the ultimate construction of a line of railway connecting the Atlantic with the Pacific, principally from the fact that in the central part of the continent there is a region, desert, or semi-desert in character,

which can never be expected to become occupied by settlers . . ." *Journals, Detailed Reports, and Observations relative to the Exploration, by Captain Palliser, of British North America*, London, 1863, *The General Report*, p. 4. (Hereafter referred to as Palliser, *Journals, Detailed Reports*, etc.)

⁸ Webb, *op. cit.*, p. 159.

⁹ *Ibid.*

the Gulf of Mexico. While the implication was that the geographic conditions prevailing north of the border were similar to those known to exist from the border southward, there is no indication that American investigators had made any point of establishing precisely the degrees of similarity or difference. If the Canadians or the British were to acquire a specific knowledge of the plains area of Rupert's Land after 1850 they would obviously have to organize and conduct their own exploratory missions.

Both the British government and the government of the Province of Canada did, in fact, investigate the western territories in the late eighteen-fifties. In 1857 there arose the question of the renewal of the Hudson's Bay Company's exclusive fur-trading licence on the Pacific coast. The British government appointed a parliamentary committee to consider the matter and took the opportunity to question the officials of the Company concerning the agricultural capabilities of the Red River area and the plains beyond. The emphatic opinion of the officials was that Rupert's Land was without agricultural possibilities. Sir George Simpson, Governor of the Company, held that even the Red River region was not well suited to settlement. He pointed out that the Company had had to import wheat supplies for the settlers within recent years. The soil, he said, was poor except on the river banks, and frost was a common destructive factor. Of the Saskatchewan country he said, "the crops are even less certain on that river, the scarcity of timber

is also a great bar."¹⁰ The plains beyond the banks of the Red River had, he said, been tried and found poor.

The same year (1857) the British government through its Colonial Office sent an expedition to western Canada under the direction of Captain Palliser. Palliser was instructed to explore the territory between the north branch of the Saskatchewan River and the United States boundary, and between the Red River and the Rocky Mountains. Within this area he was to determine "the nature of its soil, its capability for agriculture, the quantity and quality of its timber, and any indications of coal or other minerals."¹¹ He was to go to the West by way of Lake Superior and to record carefully all levels between Lake Superior and Lake Winnipeg. From the western margins of the plains area he was "to endeavour to ascertain whether one or more practicable passes exist over the Rocky Mountains within the British territory, and south of that known to exist between Mount Brown and Mount Hooker."¹²

Palliser explored in the West during the years 1857 to 1860 inclusive. His reports were voluminous but the gist of them can be concisely stated and for the most part can, in fact, be presented in his own words by the selection of a few key paragraphs from his reports. His remarks concerning transportation connections to the east and west of the plains area are not of particular relevance to this study. We need only mention that he dismissed as beyond the realm of practicability the idea of a line of communication from the settled areas on the

¹⁰ Cited in Mackintosh, W. A., *Prairie Settlements The Geographical Setting* (Toronto, 1934) p. 29.

¹¹ Palliser, *Papers Relative to the Exploration of British North America* (London, 1859), p. 4.

¹² *Ibid.*, p. 3.

St. Lawrence to the Pacific entirely through British territory. On the east he held that the natural communication route between Canada and the Red River settlement was southward by way of the Red River valley to St. Paul. He pointed out that American railways, approaching St. Paul in 1857, were in the next year or so being rapidly extended to Pembina on the boundary, and that a railway through the western British territories might eventually be constructed from that point to run in a north-westerly direction across the fertile portions of the plains. In any case, he argued, it would not be worthwhile to attempt to link the Red River settlement with Lake Superior through British territory. As for the mountains, although he traversed several passes through the lower Canadian Rockies and crossed the Cascades through British territory, he gave it as his opinion that it would not be practicable to establish road or other communications between the plains and the Pacific coast entirely to the north of the American boundary.

For the purposes of this study it is of more importance to note what Palliser has to say about the nature and agricultural possibilities of the plains between the Red River and the Rocky Mountains. Briefly his findings in this area of inquiry were as follows: (1) The valleys of the Red and Assiniboine rivers possessed excellent agricultural prospects which, even in the Red River settlement, were as yet only slightly developed. (2) Farther to the west the arid plains of the United States, without agricul-

tural possibilities, extended northward into British territory. (3) This extension formed a comparatively shallow "triangle" around which there existed a fairly extensive arc, eighty to one hundred miles in depth, of fertile and well-watered land from which the ancient forest had been removed by the repeated firing of the plains by the natives. He stated that the infertile triangle was based on the boundary (the 49th parallel of latitude) between 100 and 114 degrees west longitude and that its apex reached to 52 degrees north latitude. Beyond that the fertile belt stretched to 54 degrees north latitude. His map (cf. p. 79), however, did not substantiate the impression of geometric exactitude created by his verbal description.

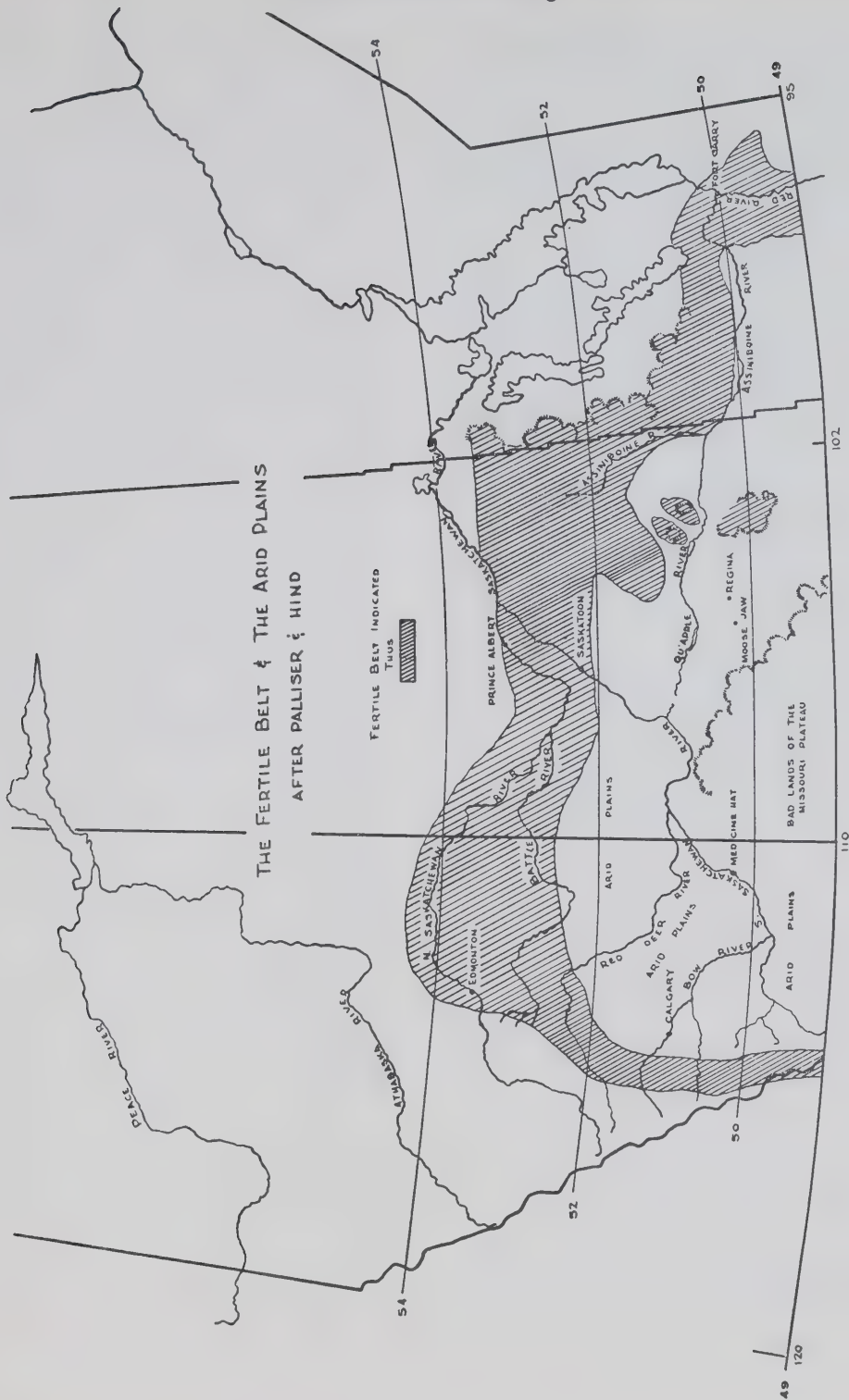
The following quotations from Palliser's reports summarize his descriptions of the different parts of the plains region. The first excerpt indicates the relationship between the western Canadian zones and those of the United States. It also gives outlines of the boundaries of the arid "triangle".¹³

"The fertile savannahs and valuable woodlands of the Atlantic United States are succeeded, as has been previously alluded to, on the west by a more or less arid desert, occupying a region on both sides of the Rocky Mountains, which presents a barrier to the continuous growth of settlements between the Mississippi Valley and the States on the Pacific coast. This central desert extends, however, but a short way into the British territory, forming a triangle, having for its base the 49th parallel from longitude 100 degrees to 114 degrees W., with its apex reaching to the 52nd parallel of latitude.

"The northern forests, which in former times descended more nearly to the frontier of this central desert, have been greatly encroached upon and, as it were, pushed backwards to the north through the effect of frequent fires.

¹³ *Journals, Detailed Reports, etc.*, p. 7. Later in his report Palliser was careful to point out that the arid parts of the Canadian territories did not comprise a second Great American Desert. "In the summer of 1859," he said, "the Expedition traversed the most arid

plains that lie within the British territory, without however encountering any of the great expanses of true desert country which exist further south, within the United States." *Ibid.*, p. 270.



"Thus a large portion of fertile country, denuded of timber, separates the arid region from the forest lands to the north, and the habit which the Indian tribes have of burning the vegetation has, in fact, gradually improved the country for the purpose of settlement by clearing off the heavy timber, to remove which is generally the first and most arduous labour of the colonists."

A later paragraph contrasts the "true prairie district", or arid zone, with the fertile park belt which surrounds it on the north:¹⁴

"... let us imagine a line drawn from 60 miles south of Fort Carlton, which is on the verge of the great prairies, to the Wiguatinou, and thence produced to the site of old Bow Fort. This line marks the boundary of two natural divisions of the country, viz., the ancient forest lands and the true prairie district. To the north of this line generally there is timber, a good soil for agricultural purposes up to 54 degrees north latitude, and superior pasturage; to the south there is no timber, the soil is sandy, with little or no admixture of earthy matter, and the pasture is inferior. Exceptions of course may be found, as for example in the neighborhood of swamps and gullies, where the soil and pasture are better. The entire absence of wood on the prairie lands is felt by the Plain Indians during the severe months of winter. During the summer they use as fuel the bones and dung of the buffalo, but in winter they are obliged to retreat to the borders of rivers where they can obtain wood."

Several consecutive paragraphs from Palliser's report are of particular interest as bearing specifically on the drainage basin of the South Saskatchewan River. The most pertinent of these paragraphs are reproduced here as follows:¹⁵

"The South Saskatchewan, which in its upper part is called Bow River, resembles the North Saskatchewan in size, volume of water, and its general direction, but it passes through a very different description of country.

"After leaving the eastern limit of the country that is within the influence of the mountains (which

may be considered to commence about 20 miles below where it receives Isquasquehow River), the South Saskatchewan flows in a deep and narrow valley, through a region of arid plains, devoid of timber or pasture of good quality. Even on the alluvial points in the bottom of the valley trees and shrubs only occur in a few isolated patches. The steep and lofty sides of the valley are composed of calcareous marls and clays that are baked into a compact mass under the heat of the parching sun. The sage and the cactus abound, and the whole of the scanty vegetation bespeaks an arid climate. The course of its large tributaries, Red Deer River and Belly River, are through the same kind of country, except in the upper part of the former stream, where it flows through rich partially wooded country similar to that on the North Saskatchewan.

"Towards the confluence of Red Deer River and the South Saskatchewan, there are extensive sandy wastes. For 60 miles to the east of this point the country was not examined by the Expedition, but at the elbow the same arid description of country was met with, and it seems certain that this prevails throughout the entire distance. Below the elbow the banks of the river and also the adjacent plains begin to improve rapidly as the river follows a north-east course and enters the fertile belt. From the Moose Woods to its confluence with the North Saskatchewan it in no way differs from that river, which indeed is nearly flowing parallel with it, only 30 or 40 miles distant.

"In the midst of the arid plains traversed by the South Saskatchewan, there are isolated patches of table land, upon the surface of which the vegetation becomes luxuriant, and pasture of fair quality may be found (e.g., the Hand Hills and the Cypress Hills).

And, finally, in one paragraph Palliser reiterates his observations concerning the apparent infertility of the short-grass plains:¹⁶

"The true arid district, which occupies most of the country along the South Saskatchewan, and reaches as far north as Lat. 52 degrees, has even early in the season a dry parched look. In the northern district the accumulation of humus, and the distribution of the pleistocene deposits, have given rise to a great variety in the nature of the soil; but to the south the

¹⁴ *Journals, Detailed Reports, etc.*, p. 89.

¹⁵ *Ibid*, p. 11.

¹⁶ *Ibid*, p. 246.

cretaceous and tertiary strata almost everywhere come to the surface, so that the stiff clay, highly impregnated with sulphates, bakes under the influence of the clear sun of early spring into a hard and cracked surface, that resists the germination of seeds. This must be the principal reason for the arid plains ranging to such a high latitude, as there is quite a sufficient quantity of moisture in the atmosphere during the summer months to support a more vigorous vegetation, as is shown (by the growth of trees in the Cypress Hills). The grass is very short on these plains, and forms no turf, merely consisting of little wiry tufts. Much of the arid country is occupied by tracts of loose sand, which is constantly on the move before the prevailing winds. This district, although there are fertile spots throughout its extent, can never be of much advantage to us as a possession. In June and July, the Expedition experienced great inconvenience in traversing it, from want of wood, water, and grass."

In 1857, the same year that Palliser was sent to the Canadian West, the government of the Province of Canada sent an expedition to explore and determine the most satisfactory route of communication between Lake Superior and the Red River. Professor H. Y. Hind of Trinity College, Toronto, was geologist and naturalist for this expedition. In the following year, 1858, Professor Hind was placed in charge of an expedition to explore the Assiniboine and Saskatchewan River valleys to determine their agricultural possibilities. His findings were in all major respects very similar to those of Palliser, and his reports, published in 1860, relied considerably on Palliser's work for corroborative detail. Hind, however, stressed the fact that rainfall conditions appeared to be better in the arid regions in British territory than they were farther south in the United States. His comments on this distinction follow:¹⁷

"The arid region, or Great Plains, west of the 101st degree of longitude, receives a very small amount

of precipitation from the humid south winds coming up the Valley of the Mississippi from the Gulf of Mexico. It is too far south to be much affected by northeast winds, or the westerly winds from the Pacific. This vast treeless prairie forms, in fact, the northern limit of the great arid region of the eastern flank of the Rocky Mountains; but still its humidity is greater than that of the plains south of the Missouri, in consequence of its high northern latitude.

"Warm air from the Pacific, loaded with moisture, passes at certain periods of the year over the whole range of the Rocky Mountains in British America and in the United States. These Pacific winds occasion but a very small precipitation of rain or snow on the eastern flank of the Rocky Mountains, south of the great Missouri Bend. Similar winds from the Pacific do occasion a considerable precipitation in the northern part of the Saskatchewan Valley. Whence, then this apparent anomaly? It probably arises from the difference in the temperature of the two regions, the direction of the prevailing winds, and the lowness and comparatively small breadth of the Rocky Mountain ranges in that latitude

"In the latitude of the Valley of the Saskatchewan . . . the moist south-west winds from the Pacific find a depression in the Rocky Mountain range and a low contracted plateau; they lose less humidity than winds passing over the higher and broader ranges to the south, and meet with a prevailing north-easterly wind as they begin to descend their eastern flanks; their temperature is consequently lessened instead of being elevated, and their capacity for moisture diminished; hence, precipitation in the form of rain and hail takes place in descending the slope towards Lake Winnipeg.

"There is no doubt that the south-west Pacific winds, passing through the depression in the Rocky Mountains near the 49th parallel, and over the narrow plateau on which they rest, without losing the whole of their moisture, give humidity to the large portion of Rupert's Land they traverse."

4. *Inter-Relationship between South Saskatchewan and Qu'Appelle Rivers:* Both Palliser and Hind noted the close inter-relationship existing between the valley of

¹⁷ Hind, H. Y. *Narrative of the Canadian Exploring Expeditions*, Vol. II, pp. 359-61.

the South Saskatchewan and the Qu'Appelle lake and river system. Pallister commented as follows:¹⁸

"At the Elbow I found a large tributary flowing from the east into the Saskatchewan . . . which I find flows from the most western of the chain of 'Qui Appelle' lakes, being navigable to large boats the whole way. Hence I have been able to ascertain that there exists a valuable water communication between the South Saskatchewan and Red River, and that a good sized boat, and even perhaps a small steamer, might descend from the South Saskatchewan, ascend the West Qui Appelle River, cross the Qui Appelle Lakes, and then descend the Qui Appelle into Red River.

"Immediately after breakfast Dr. Hector started with a branch party to explore the country to the east of the elbow, and found a small stream descending to the Saskatchewan from swampy lakes to the eastward. These lakes also send off waters to the Qu'Appelle, flowing in the opposite direction; and a very remarkable feature exists here, viz., that the summit level which divides these two streams lies in a valley more than 100 feet deep, and continuous with that of the Qu'Appelle, only 90 feet above the Saskatchewan. This valley runs N.N.E. and S.S.W. To the westward is a country covered with sand hills

Hind commented on the relationship between the two river valleys in somewhat greater detail:¹⁹

"The valley of the Qu'Appelle River joins the Assiniboine about five miles above Fort Ellice. It is 269 miles long, and appears to be a former continuation of the South Branch (of the Saskatchewan River), in a direction nearly due east, to the low regions now occupied by Lakes Manitoba and Winnipeg. Its western extremity issues from the South Branch at the Elbow, or the point where that river, from a southeasterly course, suddenly takes and preserves for 250 miles a north-easterly course, until it joins with the North Branch.

". . . The highest part of the bottom of the Qu'Appelle valley is only 85 feet above the South Branch at its summer level, and from 75 to 78

feet above it during the spring elevation of its waters. This occurs at a point distant 11½ miles from the junction, where a lake is found, which discharges itself both into the Saskatchewan and Assiniboine. Before connecting with the Assiniboine, it falls about 280 feet in 256 miles, or 1 foot 1 inch per mile. The difference of level between the South Branch at one end of the Qu'Appelle Valley and the Assiniboine at the other, does not exceed, according to our estimate, 200 feet."

Palliser's observations concerning the inter-relationship of the Qu'Appelle and the South Saskatchewan led him to suggest the feasibility of a water-communication system connecting the two. Hind went on to suggest the construction of a dam across the South Saskatchewan to divert its waters down the Qu'Appelle Valley, its former outlet. He said:²⁰

"The construction of a dam 85 feet high and 800 yards long would send the waters of the South Branch down the Qu'Appelle Valley and the Assiniboine into Red River, thence past Fort Garry into Lake Winnipeg.

"The same result would be produced if a cutting were made through the height of land in the Qu'Appelle Valley to the depth of forty or fifty feet, and a dam some thirty or forty feet high thrown across the South Branch. A second dam below the mouth of the Souris Forks would send these waters through the valley of that river into the Little Souris, thence into Lake Winnipeg by the Assiniboine and Red River. The time may yet arrive when the future population of Rupert's Land and Dakota territory will find it advantageous to construct these or similar works, even if they should be for the purposes of irrigation or inland navigation."

The Souris Forks creek or river referred to in the above citation is the stream which is currently called Wascana or Pile of Bones Creek flowing through the City of Regina. On Hind's map this stream is called "Elbow Bone Creek or Souris Forks." In a footnote

¹⁸ Palliser, *Papers Relative to the Exploration of British North America* (London, 1859) p. 14, and *Journals, Detailed Reports, etc.*, p. 54.

¹⁹ Hind, H. Y., *Canadian Red River and Assiniboine and Saskatchewan Expeditions* (London, 1860) Vol. I, pp. 426-7.

²⁰ *Ibid.*, pp. 428-9.

(Vol. I, p. 427 n.) Hind refers to Palliser's designation of this creek as "Many Bone Creek". "The Indians say", Hind reports, ²¹ "that the Souris River of the Qu'Appelle [i.e., the Souris Forks Creek mentioned above], coming from the Grand Coteau de Missouri, inosculates with an arm of the Souris of the Assiniboine before described [i.e., the Little Souris or Mouse River] and that a canoe in high water might pass from one river to the other without a portage. If this be the case, the diversion of the waters of the South Branch down the Qu'Appelle Valley would acquire additional importance, and give value to an immense extent of territory, now comparatively inaccessible, and very insufficiently watered."

5. *Varying Degrees of Aridity within the "Arid" Zone:* The map that is reproduced on page 81 indicates the boundaries of the arid and fertile areas as defined by Palliser and Hind. The map is taken from Hind's reports with, of course, the addition of cities and provincial boundaries to serve as present-day landmarks. Palliser's maps showed the western portions of these areas but not the eastern. His verbal descriptions indicated, however, that the eastern margin of the arid zone was along a line running in a northwesterly direction from the boundary at the 100th meridian. Hind's explorations were more particularly in the eastern part of the prairie region, in the area between the Red River and the elbow of the South Saskatchewan River. In preparing a generalized map to accompany his report as published in 1860, Hind had early issues of Palliser's reports and maps before him. From these and from his own observations he prepared

a composite map of the entire area between the Red River and the Rocky Mountains. For the western part of this region he adopted Palliser's delimitation of boundaries while for the eastern part he relied on his own observations. This is the map adapted for inclusion in the present analysis.

Neither Palliser nor Hind made any subdivision of the "arid triangle" in terms of gradations of aridity. They had no rainfall records for the region and, judging the agricultural possibilities of the various zones by their observations of natural vegetation and by very spotty sampling of the soils, they defined the margins, roughly speaking, of the short-grass plains and characterized these plains as wholly unfit for settlement. In the light of later settlement and agricultural experience, and in terms of present-day climatic and soil-survey information, it is known that the "arid triangle" possesses a considerable range of average annual moisture conditions and a corresponding range of agricultural possibilities.

Certain distinctions within the western plains can be made clear if we adopt a classification of regions on the basis of rainfall conditions somewhat as follows:

<i>Regions</i>	<i>Average Annual Precipitation</i>
Humid	20 inches or more
Sub-humid	15 to 19.9 inches
Semi-arid	10 to 14.9 inches
Arid	less than 10 inches

On the basis of this classification, and with the rainfall records which are currently available, we can note that Palliser's "triangle" is, strictly speaking, not arid at all but is rather of the semi-arid type of region, with the exception of such elevations

²¹ Hind, H. Y., *Canadian Red River and Assiniboine and Saskatchewan Expeditions* (London, 1860) vol I, p. 335.

as the Cypress Hills area. We can note further that Palliser's "fertile" belt is essentially a sub-humid area. Only beyond the latter belt, in the forest areas of the North, does the annual average rainfall (or precipitation) exceed twenty inches. It is evident, then, that the entire western wheat economy of the present day is situated in semi-arid and sub-humid zones, particularly in the former.

According to the above rainfall classification of regions there is no significant part of Palliser's "triangle" which is genuinely arid, for throughout the area the average annual rainfall varies within the limits of ten to fifteen inches. There are parts of the region, however, where the average is not more than eleven or twelve inches. Furthermore, in these areas in the south-central part of the Canadian plains region, moisture utilization is poor because of high summer temperatures and dry-wind conditions. It must also be kept in mind that *average* precipitation data give no suggestion of annual variations and the extent or frequency of these in relation to the mean. A region with an average precipitation of eleven or twelve or thirteen inches per year will have cycles of moisture conditions, some years or series of years with annual rainfall adequate for the growth of cereal crops, to be followed, unpredictably, by years or series of years with rainfall quite inadequate for the purpose.

These circumstances combine to create, in effect, a second triangle within Palliser's triangle. This inner triangle has as its vertical axis the Alberta-Saskatchewan boundary with a base on the United States border approximately one-half that of Palliser's arid zone and extending north-

ward approximately to the northern limit of that zone as defined by Palliser. It forms the hard core of the drought area of the Prairie Provinces. It was the last area in the southern part of the prairie provinces to be occupied on the basis of homestead settlement and comprises the area of heavy land abandonment in the inter-war years. Within this area the C.P.R. selected only a negligible part of its land grant, regarding the lands of the region as a whole as "not fairly fit for settlement". It includes the irrigated areas and the region subject to Special Areas legislation of 1927 and later years in the Province of Alberta. Within Saskatchewan it covers that part of the province to the west of the Missouri Coteau or, generally speaking, to the west of a line running through Moose Jaw and the Elbow of the South Saskatchewan, the line extending in a south-easterly direction to the United States border and in a north-westerly direction to the Alberta-Saskatchewan boundary. It will be noted that this area corresponds roughly with the drainage basin of the South Saskatchewan River down to the Elbow. Reference will be made later in this analysis to this triangle within a triangle (*see below*, pp. 103-5, 106 ff.)

Since the time of Palliser's explorations the concept of an arid triangle in the southern heart of the Prairie Provinces has retained such prominence in generalized analyses of the Canadian plains region that sub-division within that area has not ordinarily been attempted. It should be pointed out, however, that Hind took note of the fact that the "arid" zone as outlined by Palliser in reality comprised two zones instead of one. While he noted the distinction he neverthe-

less placed no particular emphasis upon it and in the final analysis was content to adopt Palliser's zonal classification.

Hind's reference to the dual nature of Palliser's arid zone was in a sense parenthetical. He was complaining about the lack of precision in the everyday usage of the terms "plains" and "prairies". It was his contention that the term "prairies" should be used only in reference to fertile areas while plains were basically infertile areas. Thus he quoted a geological report which described the prairie area of the United States as that territory lying between the heavily wooded areas of the East and the arid plains of the West. In the United States, the report pointed out, the true prairie region extended "over the eastern part of Ohio, Indiana, the southern portion of Michigan, the southern part of Wisconsin, nearly the whole of the States of Illinois and Iowa, and the northern portion of Missouri, gradually passing, in the territories of Kansas and Nebraska, into the *Plains*, or the arid and desert region which lies at the base of the Rocky Mountains. This passage takes place in the region between the meridians of 97 degrees and 100 degrees, west of which belt the country becomes too barren to be inhabited and worthless for cultivation. . . ."²²

Applying this analysis to Rupert's Land, Professor Hind made the following comments:²³

"The true limit of the Plains in Rupert's Land, east of the South Branch, is well shown by the Grand Coteau de Missouri. The country east of that natural boundary may be classed as Prairie country, over the greater portion of which forests of aspen would grow if annual fires did not arrest their progress. The plateau of the Grand Coteau (de Missouri) forms the

true Plains of Rupert's Land, where both soil and climate unite in establishing a sterile region The Grand Coteau de Missouri, distinctly visible from the Eyebrow Hill, begins in latitude 45 degrees it enters British Territory near the 104th meridian, and still preserving a north-westerly direction comes on the South Branch of the Saskatchewan, a few miles from the Elbow, in longitude 108 degrees. The region east of the Grand Coteau belongs to the prairie region, the Grand Coteau itself and its prolongation towards Battle River, from its eastern boundary to the foot of the Rocky Mountains, constitutes the "Plains" properly so-called of the north-western territories of the United States and of British America. From the character of its soil and the aridity of its climate, the Grand Coteau is permanently sterile and unfit for the abode of civilized man.

A few pages earlier in his report Professor Hind stated: "On the flanks of the Grand Coteau the true prairies may be said to terminate, and the plains to commence."²⁴ His doubts over the proper classification of the treeless Regina plains or prairie area, however, are shown when he follows the above sentence with the statement that, "It is doubtful whether the term 'Plain' is not now applicable to a large portion of the country west and south of the Qu'Appelle Mission. The destruction of 'woods' by fires has converted into sterile areas an immense tract of country which does not appear necessarily sterile from aridity, or poverty of soil." It may have been uncertainties of this kind that persuaded Hind finally to ignore any fine distinction between prairies and plains and to adopt Palliser's simpler classification which distinguished only between arid and fertile areas, and which made that distinction on the basis of existing vegetation.

²¹ Hind, H. Y., *Canadian Red River and Assiniboine and Saskatchewan Expeditions* (London, 1860) vol. I, p. 349.

²³ *Ibid.*, pp. 350-1.

²⁴ *Ibid.*, p. 348.

II. Preparation for Settlement in the Canadian West

1. Confederation and Communications.—

The explorations and reports of Palliser and Hind indicated that the British territories between the Red River and the Rocky Mountains included both an arid zone and an extensive fertile belt. So uncertain had been the western prospect before this time, however, that the strong assurance of the existence of a broad fertile area across the plains did more to influence eastern thought than did the confirmation of the vague general knowledge that some of the West was unsuitable for settlement. Both Palliser and Hind were enthusiastic about the agricultural capabilities of the Red and Assiniboine river valleys. They concurred in the view that agricultural settlement might extend from this area to the Rocky Mountains through territory generally favorable to agricultural pursuits. Although Palliser was convinced that it would not be practicable to build a railway from the eastern colonies to the Pacific coast entirely in British territory, Hind was as fully convinced that such a route was feasible. Gold discoveries on the Fraser River in the early eighteen-fifties were followed by further discoveries in the Cariboo in the early eighties. This variety of new information did much to convince influential persons in the Province of Canada that western economic development might be fostered successfully within the framework of a comprehensive national policy. Gradually the policy took shape.

Without going into excessive detail the establishment of the main prerequisite conditions of western development can be outlined. A project in nation building such as

was thus envisaged was far beyond the resources of the individual colonies and required a more comprehensive union than that which had created the United Province of Canada in 1841. This broader union was effected by Confederation in 1867, which united four colonies and provided for the later entry of the entire remaining British North American domain. The newly-created Dominion government was given responsibility for the major national purposes, defence and economic development.

The hostility of the Hudson's Bay Company to agricultural expansion in Rupert's Land made it imperative that the Company's charter rights should be liquidated and the territories transferred to the Dominion. This was accomplished by 1870. Plans had to be made for the construction of a Pacific railway, and after several uncertain starts the Canadian Pacific syndicate was chartered in 1881 to link Montreal with the Pacific coast by way of an all-Canadian route. The main line was completed in 1885, the route involving construction around the north shore of Lake Superior in defiance of Palliser's argument that the "natural" communication route between eastern Canada and the West was by way of Minneapolis-St. Paul and the Red River valley. Furthermore, the line was built straight east and west through the heart of the arid plains instead of curving northward with the arc of the fertile belt as projected in the original survey. The Kicking Horse Pass was much more difficult and costly to surmount than the Yellowhead Pass to the north. The southern route was, of course, more direct, but of greater importance was the fact that it provided a defence against the threat of encroachment by American railways from south of the bound-

ary. West of Moose Jaw—or, as Hind would have said, on the Plateau of the Grand Coteau de Missouri—the Canadian Pacific Railway company declined to select any significant part of its land grant on the ground that its charter excused it from accepting any lands which were “not fairly fit for settlement”.

2. *Dominion Lands Policy.* The primary economic objective of the national policy was the establishment of a new frontier, an area where commercial and financial activity could readily expand and where labor and capital might find profitable employment. In terms of the international competition of the day the requirement was for an agricultural frontier which could attract an adequate proportion of the annual flow of emigrants from the British Isles and Europe. Of two and one-half million emigrants who left the European countries during the years 1853 to 1870, 61 per cent went to the United States, 18 per cent went to the Australian colonies, others went to Brazil and Argentina, and a mere trickle arrived in Canada.²⁵ After the passage of the United States homestead law in 1862 it was clear that nothing less generous than that would serve to divert the flow of European emigrants to a Canadian frontier.

The transfer of Rupert's Land in 1870 gave to the Dominion Government the rough equivalent of the American Public Domain and the raw materials for the creation of a new agricultural frontier. A new problem arose in 1870 when a part of Rupert's Land was accorded provincial status as the Province of Manitoba. According to the British North America Act (sec. 92, ss. 5) the

provinces were to retain possession and control over the disposal of their unalienated lands. In order to maintain Dominion control over the western public domain, whether within provincial boundaries or in the territories beyond, the Dominion Government found it expedient to introduce an inconsistency in the land control legislation. The Manitoba Act of 1870 provided that “All ungranted or waste lands in the Province shall be . . . vested in the Crown, and administered by the Government of Canada for the purposes of the Dominion”. In the Territories beyond the Province of Manitoba the question of jurisdiction over public lands did not arise until 1905 when the Provinces of Saskatchewan and Alberta were created. The Manitoba principle was extended to them at that time and public lands in the three Prairie Provinces remained as Dominion lands until 1930. While, therefore, the four original provinces of Confederation, and British Columbia and Prince Edward Island on entry into Confederation, all retained their natural resources without question at any time, the three Prairie Provinces acquired control over their public lands and natural resources in general only after 1930.

The public lands of Manitoba and the North-West Territories, or after 1905 of the Provinces of Manitoba, Saskatchewan and Alberta, had to serve two purposes which could never be wholly harmonized. Under free homestead privileges these lands had to serve as an attraction for immigrant and other settlers. But a Pacific railway had to be built in order to develop the West and to make possible the creation of a con-

²⁵ Cf. V. C. Fowke, *Canadian Agricultural Policy* (Toronto, 1946), p. 169.

continent-wide nation. The Dominion Government, in conformity with American example, gave assurance that the railway would cost the taxpayer nothing, that it would be built out of the revenues of land resources. The Canadian Pacific syndicate was thus granted twenty-five million acres of the public domain, and prairie lands had therefore to serve to finance railway construction as well as to attract immigrants. The proviso in all railway land-grants that the railways need select only those lands which were "fairly fit for settlement" meant that homestead entries were long delayed in certain areas pending the selection of such lands by the railways and, in the end, were often made available in areas in which the railways declined to accept any lands because of the opinion that such lands were not fairly fit for settlement.

Homestead regulations were provided in Dominion Orders-in-Council in 1871 and were incorporated in the Dominion Lands Act of 1872. Settlers were thus entitled to secure entry to a quarter-section (160 acres) of land on payment of a ten dollar fee. Within the railway zone, a belt twenty miles in width on either side of a Pacific railway which was to be built, homesteading was not to be permitted. Regulations were changed from time to time and most significantly in 1879 and 1882 when, in effect, the even-numbered sections of all Dominion Lands were opened for homestead entry. In areas where the railways selected their grants as the odd-numbered sections, it developed, therefore, that homesteaders had railway lands adjacent to their individual holdings available for purchase in order to enlarge their farms beyond the original quarter-section size. It has been argued and fairly con-

clusively demonstrated that the Canadian Pacific Railway company sold its land holdings over the years at prices which were better designed to encourage occupation and development of the West than to extract the maximum in sales returns.

Homestead and railway lands did not make up the total land area of the western provinces available for private settlement. Allocated in specific parcels throughout the entire area were Hudson's Bay Company and school lands. As a part of the arrangement whereby the charter rights of the Hudson's Bay Company were relinquished, the Company was allowed to retain one-twentieth of the land in the "fertile Belt," the latter defined in this case as comprising the total area between Lake Winnipeg and the Rockies and between the United States boundary and the North Saskatchewan River. This grant amounted to approximately 6.6 million acres. A further allocation of one-eighteenth of all western lands was made for educational purposes.

The distribution of these various categories of lands can best be understood in relation to the system of the western survey. It was originally proposed to survey the western territories into blocks containing 800 acres made up of four two-hundred acre lots. It was very early decided, however, to duplicate in Canada the American system of western survey because it was already familiar to potential immigrants by American example. This involved the survey and division of agricultural lands into "sections" one mile square, containing 640 acres, and the subdivision of these units into quarter sections, one-half mile square containing 160 acres. Road "allowances", four rods in width, were provided one mile apart running north and

south and ordinarily two miles apart running east and west. Thus every quarter section—regarded as the basic settlement unit—fronted on at least one road allowance. The sections were in turn combined into larger units, townships, six miles square (neglecting road allowances), and thus containing 36 sections of land. The townships, lying in north-south “ranges”, were numbered consecutively northward from Township 1 in each range at the international boundary. The ranges were numbered consecutively westward from meridian lines.

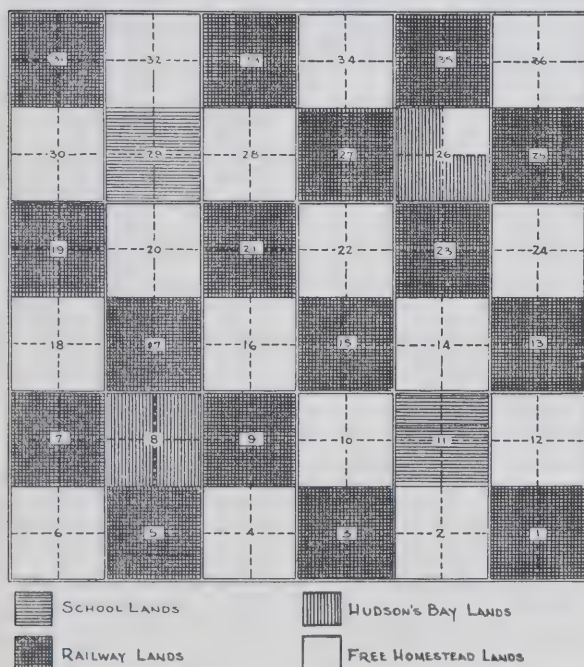
The diagram illustrates what might be called the typical township in the Prairie Provinces prior to settlement. Section 8 and three-quarters of section 26 (all of section 26 in every fifth township) were Hudson’s Bay

Company lands. Sections 11 and 29 were school lands. The remaining sixteen odd-numbered sections—in areas regarded by railways as “fairly fit for settlement”—were railway lands. And, finally, the sixteen or sixteen and one-quarter even numbered sections were available for homestead entry.

3. *Western Development in the Period from 1867 to 1900.*—The 30-year period after Confederation laid the foundations for the prairie wheat economy. Settlement awaited the construction of railways, although, conversely, areas through which railways were constructed were not in all cases immediately occupied. Even before Confederation Professor Hind had observed that American railways already reached beyond Chicago to St. Paul and were, in fact, extending through the upper Mississippi valley into the Red River valley and were approaching Pembina on the international border. In 1878 this line was extended northward to Winnipeg, thus providing the first all-rail connection between the Red River settlement and the outside world. In 1883 the Canadian Pacific Railway linked Winnipeg with eastern Canada by the north-shore route. In 1885 the western part of the C.P.R. was completed from Winnipeg to Vancouver (or Port Moody) via the difficult Kicking Horse Pass and through the heart of the semi-arid plains, through Palliser’s “triangle”.

Within the next six or eight years a considerable mileage of feeder and connecting railways was constructed in Manitoba and the Territories beyond. A number of branch lines radiated from Winnipeg into south-western Manitoba with an extension or two into the southeastern Territories. To the north of the C.P.R. main line the Manitoba

LAND DISTRIBUTION IN A TYPICAL
WESTERN TOWNSHIP



and North-Western was completed into the Territories, linking the Yorkton district with Winnipeg by 1890. The C.P.R. secured control of the Minneapolis, St. Paul and Sault Ste. Marie railway, which reached northward to Portal on the boundary, and extended it from Portal to Moose Jaw. "Vertical" lines were constructed in the Territories, one to link Regina with Prince Alberta via Saskatoon, and one through Calgary to Edmonton on the north and Macleod on the south. A narrow-gauge railway which had linked Medicine Hat with Lethbridge by 1885 was taken over by the C.P.R. and in the late 1890's was extended through the Crow's Nest Pass to the Kootenay Valley. There were approximately 3700 miles of railway in Manitoba and the North West Territories by 1900.

Railway construction contributed to the settlement process in two ways. In the first place, the completed railway was indispensable to the production and marketing of a bulky cash crop such as wheat. Settlement therefore never advanced far beyond the "end of steel" whether already completed, under construction, or, at the very least, projected for early commencement. In the second place, the construction of railways provided a source of cash income for settlers and potential settlers. Railway construction in the west before 1900 therefore provided a marked stimulus to agricultural expansion, and at the same time marked out the limits of the areas within which such expansion might for the time being be regarded as feasible.

Table 1 indicates the progress of homestead location in the 60-year period following

the introduction of the homestead land-grant system in Canada. Referring particularly at this point to the period before 1900, it will be noted that approximately 80,000 entries had been made by the turn of the century, a total for the twenty-six-year period smaller than that for the first five-year period in the new century. It will also be noted that the five-year period, 1880-85, during which the C.P.R. main line was constructed, had the largest number of homestead entries (22,126) of any five-year interval before 1900.

TABLE I

*Number of Homestead Entries in Western Canada,
1874-1933*

Year	Number of Entries		Year	Number of Entries	
	For the Year	Five-year Total		For the Year	Five-year Total
1874	1,376	8,923 (6 yrs.)	1900	7,426	87,682
1875	499		1901	8,167	
1876	347		1902	14,633	
1877	845		1903	31,383	
1878	1,788		1904	26,073	
1879	4,068				
1880	2,074	22,126	1905	30,891	163,912
1881	2,753		1906	41,869	
1882	7,483		1907	21,647	
1883	6,063		1908	30,424	
1884	3,753		1909	39,081	
1885	1,858	13,622	1910	41,568	190,726
1886	2,657		1911	44,479	
1887	2,036		1912	39,151	
1888	2,655		1913	33,699	
1889	4,416		1914	31,829	

Number of Homestead Entries in Western Canada,
1874-1933 (Conc.)

Year	Number of Entries		Year	Number of Entries	
	For the Year	Five-year Total		For the Year	Five-year Total
1890	2,955	18,594	1915	24,088	64,863
1891	3,523		1916	17,030	
1892	4,840		1917	11,199	
1893	4,067		1918	8,319	
1894	3,209		1919	4,227	
1895	2,394	18,172	1920	6,732	28,656
1896	1,857		1921	5,389	
1897	2,384		1922	7,349	
1898	4,848		1923	5,343	
1899	6,689		1924	3,843	
			1925	3,653	
			1926	4,685	
			1927	5,760	
			1928	7,233	
			1929	16,157	
			1930	17,504	37,488
			1931	15,133	
			1932	8,108	
			1933	5,215	
					45,960 (4 yrs.)

Source: Mackintosh, W. A., *Economic Problems of the Prairie Provinces* (Toronto, 1935) App. A., p. 282.

While a substantial proportion of the homestead settlement in the West before 1900 was effected by individuals, the establishment of colonies was a much more significant feature of the period. A number of the groups came unsolicited. In 1872, for example, the German Mennonites of the Province of Berdiansk, Russia, investigated

the possibilities of transfer to western Canada. In addition to free land for settlement they sought and secured the guarantee of educational freedom and of exemption from military service. They were granted financial assistance toward their passage, and settlement reservations were set aside for them in the Red River valley. By 1876 there were 6,150 Mennonites in the Manitoba settlements. In 1874 the first reservations were made in western Canada for French Canadians repatriated from the New England states. In the 10-year period, 1876-85, 4,800 of these migrated to the West to form 10 new settlements and to add to a number of others. In 1875 and 1876 an Icelandic colony was formed on the west shore of Lake Winnipeg. Until the end of the century the numbers of settlers in the West, whether as individuals or in colonies, remained generally disappointing, but a wide variety of European groups was scattered throughout parts of the plains area to form the nuclei for units of later expansion. On reservations or "nominal reservations", the latter without exclusive rights of entry to allocated territory, there were groups from England and Scotland and colonies of Hungarians, Scandinavians, Germans, Roumanians, Icelanders, Mennonites, Danes, Finns, Russians, Ukrainians, Belgians and Jews. Attempts at company colonization proved unsuccessful and Professor Morton comments that, although some 30 contracts were made under the plan, "probably nobody got anything out of the scheme but the directors of the companies."

Settlement did not spread uniformly throughout the West in the period before 1900. In general this period saw the occupation of southern Manitoba to the west

of the Red River. This area with comparatively little extension constitutes the agricultural portion of that province to the present day. Settlement spread westward from the southwestern part of Manitoba into southeastern Saskatchewan and had occupied a substantial part of the east and southeastern areas of the province by 1900. Apart from this more or less consolidated region the settlement at the turn of the century was concentrated in regions scattered from Manitoba to the foothills of the Rocky Mountains, a ribbon along the line of the C.P.R., a wider strip from Edmonton southward through Calgary to the boundary and a cluster around the forks of the North and South Saskatchewan Rivers. It was already noticeable that settlers tended to avoid the short-grass plains and to occupy its margins in preference to forming a pattern of continuous settlement from east to west. This was similar to the development of western settlement in the United States half a century earlier. The drainage basin of the South Saskatchewan and of the lower portions of its tributaries was commonly still regarded as unfit for agricultural occupation. As far north as Saskatoon this area, the central core of Palliser's triangle, was still occupied only by ranching in scattered areas.

By the end of the century there were approximately 419,000 persons in Manitoba and the Territories. Of these, approximately 255,000 were in Manitoba and 91,000 and 73,000 respectively, were in the territories which today comprise the Provinces of Saskatchewan and Alberta.

4. *Improvements in Agricultural Practice: Red Fife and Summer-fallow.* It should be noted that the western development as des-

cribed above (and, indeed, the development as late as 1910) took place on the basis of Red Fife wheat which was introduced into the Red River settlement in 1870. This wheat, which had been introduced into Upper Canada in the 1840's, had gone through the mid-western states and eventually came to western Canada in replenishment of seed following a local crop failure. Red Fife was a marked improvement over the wheat formerly grown in the Red River valley. Of unsurpassed milling and baking qualities it was of high-yield capacity and had a maturity period of 115 to 125 days, as compared with that of the former Red River variety which required from 125 to 145 days to mature. The latter characteristic served to minimize the hazard of frost which was by no means negligible in the low lying areas of southern Manitoba. Red Fife continued without even a distant rival as the outstanding western Canadian wheat until after 1910 when Marquis became generally available and was widely adopted.

While the period before 1900 saw practically no settlement on the semi-arid Canadian plains it nevertheless brought agricultural occupation to the margins of these plains in eastern Saskatchewan. On these margins, in the area east of Regina, there were recurring years when summer precipitation was barely adequate for grain production. Under these circumstances a premium was placed upon the discovery and adoption of methods of cultivation which might compensate at least in part for the hazards of drought. The most significant contribution in this regard was found in the practice of summer-fallow as a means of moisture conservation. The establishment and general

recognition of the value and function of this cultural practice before 1900 was of fundamental importance in the occupation of the semi-arid plains which took place in the decade after 1906. If summer-fallowing was of great assistance to settlers on the eastern margins of the short-grass plains, where it may be said to have been introduced into the Canadian wheat economy, it was more than helpful on the plains themselves, it was indispensable.

A considerable initial impetus was given to summer-fallowing by a purely fortuitous circumstance which interfered with the routine of cultivation on the Bell Farm, a large corporate venture at Indian Head (North-West Territories). With the farm horses drafted into the hauling of military supplies for the suppression of the Riel Rebellion, spring plowing and seeding were curtailed on this farm in 1885. The idle land was plowed and cultivated during the summer as unintended summer-fallow. This acreage withstood the drought which occurred in 1886 and yielded exceptionally well. In the ensuing years Angus Mackay, director of the Dominion Experimental Farm which had been established at Indian Head in 1876, commenced and continued the practice of summer-fallowing on an experimental basis. His observations very early led him to the firm conviction that no other practice of cultivation currently known offered the prospect for offsetting drought to a degree remotely approaching summer-fallow. Mackay's report for 1889 is typical of his printed and spoken

opinion on the matter, an opinion which he urged upon western farmers at every opportunity. He said:²⁶

Our seasons point to only one way in which we can in all years expect to reap something. It is quite within the bounds of probabilities that some other and perhaps more successful method may be found, but at present I submit that fallowing the land is the best preparation to assure a crop. Fallowing the land in this country is not required for the purpose of renovating it, as is the case with worn-out lands in the east, and it is a question yet unsettled how much or how little the fallows should be worked, but as we have only one wet season during the year, it is found beyond doubt that the land must be ploughed the first time before this wet season is over, if we expect to reap a crop the following year. This wet season comes during June and July, at a time when every farmer has little or nothing else to do, and then this work should be done. Usually seeding is over by the first of May, and to have the best results the land for fallow should be ploughed from five to seven inches deep as soon after this as possible. Land ploughed after July is of no use whatever, unless there is rain in August, which very seldom comes to any great extent. A good harrowing should succeed the ploughing, and all weeds or volunteer grain should be kept down by successive cultivation.

The paragraph cited above describes what came to be known widely as "black summer-fallow", the implication of the term being that a field under summer-fallow should be worked sufficiently throughout the summer to prevent weed growth. As western settlement moved in onto the edges of the semi-arid regions and eventually (between 1906 and 1916) spread over the entire short-grass plains, black summer-fallow was accepted as a standard constituent of a three or a two-year system of crop rotation. This is not to suggest that summer-fallow was practised by all settlers, or that it was practised consistently by those who did adopt it. If a

²⁶ As cited in A. S. Morton and Chester Martin, *History of Prairie Settlement and "Dominion Lands" Policy* (Toronto, 1938) pp. 101, 106.

wet season were anticipated, and without certain knowledge it was as reasonable in the early spring to expect a wet as a dry crop year, there was every temptation for the individual farmer to get a maximum acreage in crop for the current year without undue concern for the season after.

Generally speaking, however, summer-fallowing proved to be an indispensable part of a sound, long-run pattern of cultivation throughout the wheat growing region of the Canadian West. In the drier regions its primary purpose by a considerable margin was the conservation of moisture, the "storing up" of two years' rainfall for the production of a single crop. Even in these areas, however, weed control was by no means a negligible function of the summer-fallow practice. In parts of the wheat producing area where rainfall was rather less precarious, notably within the park belt, or Palliser's "fertile belt", weed control and moisture conservation shared with rough equality in the purposes of the summer-fallow usage.

The adoption of black summer-fallow made possible the occupation of the western short-grass plains. Nevertheless it contributed immensely to the difficulties in many areas of the West in the 1920's and more particularly in the 1930's when drought and summer winds led to widespread soil drifting and the eventual abandonment of substantial areas of wheat lands in south-central Alberta and Saskatchewan. The repeated cultivation necessary for the prevention of weed growth, and adherence to the principle that moisture could best be preserved by the maintenance of a fine top-soil mulch, left summer-fallowed soils without fibre and in condition nearly pulverized. Fields in this condition were highly suscep-

ible to wind erosion. Spring winds blew the seed from the ground except under the rather unusual circumstances where crop growth had effectively covered the ground with cereal foliage before any winds occurred. Fields in such a state of tilth and without crop coverage would drift before a wind even during a light rain shower and would drift freely within a very few hours after the heaviest downpour.

By the early 1930's it was clear that the practice of summer-fallowing in western Canada would either have to be abandoned or drastically revised. Its abandonment would leave no practicable alternative as an instrument of moisture conservation. The suggestion often made that the place of summer-fallow in western crop rotation should give way to the planting of cover crops such as grasses or corn, could not be considered seriously for various reasons, among the more important of which was the substantial acreage involved on the individual farm.

Cultural practices have been markedly changed in western Canada within the past 20 years and, as might be expected, in ways which make it possible to continue the use of summer-fallow with a substantial reduction of its worst hazards. The problem has been to preserve the efficacy of summer-fallow in the conservation of moisture and in weed control without the need for methods of cultivation which would leave the top-soil without fibre and in a nearly pulverized condition. These objects have been largely attained by replacing the mouldboard plow and the disc-and-drag-harrow with one-way discs and a variety of ridging cultivators.

The "black" summer-fallow has given way to the "trash covered" summer-fallow. Whereas the mouldboard plow buried all stubble and trash beneath the plowed surface, the diskers now in use turn over the field's surface and leave the stubble and other trash mixed into the cultivated surface layer of soil. The disc-harrows formerly used for the second and subsequent cultivations of plowed summer-fallow reduced the surface to a fine tilth. The duck-foot and other ridging cultivators now in use destroy weeds effectively and at the same time leave the surface in ridges of coarse textured soil in which stubble and trash provide a variable amount of fibre. Summer-fallow, in short, is now more firmly established than ever before in the cultural routine of the wheat economy, but it is no longer the summer-fallow as advocated by Angus Mackay in the 1880's and 1890's.

In some areas strip-farming has been adopted as an additional safeguard against the hazard of soil drifting. Under this system fields are divided into alternate strips of summer-fallow and crop land. On farms where one-half the cultivated acreage is summer-fallowed each year, the alternate strips of summer-fallow and crop are of equal size. Where one-third of the acreage is summer-fallowed the alternate strips in any particular year are in groups of three, one of summer-fallow crop, one of stubble crop and one of summer-fallow. Since the wheat growing region in Canada is in the latitude of the prevailing westerly winds it is preferable to have the strip divisions running north and south rather than east and west.

III. Establishment of Canadian Wheat Economy, 1900-1930

1. *Defensive and Economic Aspects of Western Development.*—The first thirty years of the present century saw the establishment of the prairie wheat economy. The foundations had been laid in the decades before the turn of the century. Land and immigration policies had been established and railways had in large measure been provided. Many of the techniques necessary for the mastery of the plains had been introduced from other areas, or developed anew in the Canadian environment, and all had been considerably adapted to the exacting requirements of dry-land farming.

The establishment of the wheat economy was a major national achievement and its significance was of only slightly lesser relative importance for the total Canadian economy than it was for the prairie region itself. Western development on the scale which characterized it was only possible on the basis of an immigration movement of such proportions as to rank among the great population movements in history. From 1900 to 1930, four and one-half million immigrants came to Canada, three times as many as had come in the previous half century. Four hundred thousand came in a single year, 1913. Immigrants came from the British Isles, from northern and western Europe and from the United States. An estimated million and a quarter out of the thirty-year total came from the United States and of these a great proportion came directly to the Prairie Provinces. Many Canadian-born migrants from the eastern and maritime provinces moved west to swell the flood of new prairie settlement, both on

the land and in the numerous market centres that sprang up to serve the wheat growing areas around them.

It would be scarcely possible to over-emphasize the contribution which western development made toward the fulfilment of the national policy, the master plan for creating and integrating a national economy from coast to coast. It is easy today, perhaps, to forget the extent to which the development of Western Canada constituted a defensive measure against the aggressive continental nationalism of the United States. Yet the defensive nature of this development is a fact, and a fact of some significance. As early as the eighteen-forties the Americans were seized with the concept of Manifest Destiny, a concept revealingly defined by an eastern newspaperman²⁷ as "the right of our manifest destiny to overspread and to possess the whole of the continent which Providence has given us for the development of the great experiment of liberty and federated self-government entrusted to us". Ten or twelve years later both Palliser and Hind noted that economic links were already becoming firmly established between the Red River settlement and the American Middle-west via St. Paul and Chicago. As Palliser put it:²⁸ "No doubt the natural outlet of this great western district is across an easy country to the water of the Mississippi and Missouri, which if first established the West is lost to Britain". A few years later, with Confederation achieved, Macdonald commented that "the United

States Government are resolved to do all they can, short of war, to get possession of the western territory, and we must take immediate and vigorous steps to counteract them."²⁹ The construction of the Canadian Pacific Railway was one of the means of "counteracting them", and the desire to do this most effectively was one of the most important reasons for the decision to build the railway across the southern part of the prairie area, through the semi-arid plains, rather than through the northerly arc of the park belt as had originally been planned.

Simultaneously with the construction of the all-Canadian trans-continental railway the establishment of a system of protective tariffs helped to cut through the economic links which had previously been in formation between the Canadian West and the industrial areas of the American Middle-West. The construction of the Crow's Nest Pass railway by the C.P.R. in the late eightennineties struck at the spread of American economic empire, particularly that of the Great Northern Railway interests in the inter-mountain valleys to the north of the international boundary. By 1900 notice had been served upon the Americans that Canada had no intention of allowing the western territories to go by default. It remained to make this notice effective by actual and productive occupation of the empty plains.

Western agricultural development was of the utmost importance to the fulfilment of the national policy, economically as well as

²⁷ John L. O'Sullivan in the *New York Morning News*, Dec. 27, 1845, as quoted by Albert K. Weinberg, *Manifest Destiny: A Study of National Expansion in American History* (Baltimore, 1935), p. 145. As the date of the original editorial will suggest the concept was first employed in argument over title to the Oregon

Territory. It nevertheless had unmistakable implications for all other British American territories.

²⁸ Palliser, *Papers Relative to the Exploration of British North America*, p. 18.

²⁹ Pope, *Correspondence of Sir John A. Macdonald* as quoted in Morton and Martin, *History of Prairie Settlement*, pp. 225-6.

defensively. The vision of a Canadian nation with dominion from sea to sea in North America was futile if economic development were to stop at the geographic boundaries occupied by the eastern colonies at the time of Confederation. Before Confederation the westward extension of the St. Lawrence economy was limited by the lower Great Lakes and the Laurentian Highlands. The eastern extension of the Pacific-based economy was no farther inland than the Fraser valley, the first of the inland valleys of the mountain barrier. Between the eastern and western economic bases lay two thousand miles of empty Shield, empty interior plains and, finally, almost insuperable mountain ranges and empty intermountain plateaus. The wheat economy, even when fully developed as it was by 1930, spread some eight hundred miles through the plains portion of these empty spaces and thus did not occupy all or even half of the total geographic gap in the national framework. Limited though the area of western economic development was, it was nevertheless sufficient to convert a vision into a reality. The traffic-poor bridge of the Precambrian Shield remained, but the scale of economic development at both its ends had transformed it from an insuperable obstacle in the way of the achievement of a national economy to a costly but nevertheless manageable continuing handicap.

2. *Capital Requirements of Prairie Development.*—The establishment of the wheat economy did more than fill a tremendous geographic gap in the national economy. The development of the wheat producing area required hundreds of thousands of immigrants among whom the adult population of both sexes constituted, in effect, the labour

force for the production of the new staple. It required also the assembly in the Prairie Provinces of an entire structure of capital equipment without which the large-scale production and marketing of wheat would have been impossible. Most obviously this meant the outfitting of each of the hundreds of thousands of new farm units with buildings—a house or some sort of dwelling, a barn or stable, and granaries; the provision of a complete if variable set of farm machinery for cultivating, seeding, harvesting and threshing; the provision of power units, first oxen or horses and later a tractor; and along with all these, a wide variety of incidental capital such as household furnishings, fencing materials, pumps and windmills. The marketing of farm produce and the purchase of equipment and supplies by the farming population required railways and market centres, each of the latter equipped with sidings, elevators and loading platforms, warehouses and stores, and housing for the local residents.

The capital equipment for the Prairie Provinces came largely from other parts of Canada. Tariff policy contributed substantially toward this end, diverting to the Provinces of Ontario and Quebec much of the demand for machinery, tools, hardware, articles of leather, clothing and home furnishings which would otherwise have been supplied by American manufacturers. Buildings and structures of all kinds were, of course, assembled from raw lumber on the spot of their final location, but the lumber came from outside the prairie region, for the most part from British Columbia. All parts of the Dominion, with the exception of the

Maritime Provinces, expanded their industrial and other economic activity in direct response to the opening of the prairie market. Railways moved the equipment and building materials to the prairies and transported grain to eastern and export terminal markets. By 1920, wheat was the largest single Canadian export in terms of dollar value.

3. *Population and Homestead Entries.*—Within the thirty years after 1900 the population of Canada all but doubled to total 10,377,000 in 1931. Meanwhile the population of the Prairie Provinces increased more than five-fold to a total of 2,354,000. In 1901 only eight per cent of all Canadians lived on the plains. By 1931 nearly one quarter were there. Table II indicates the extent and rapidity of population growth in the Prairie Provinces after the turn of the century.

Table I indicated the tremendous concentration in homesteading activity in the years between 1900 and the outbreak of the first world war. In this fifteen year period over four hundred and forty thousand homestead entries were made in the Prairie Provinces. In the first five-year interval, 1900 to 1904 inclusive, more entries were made than in the preceding quarter of a century, and even by 1905 Canadian homesteading had not begun to approach its maximum rate. The four years from 1909 to 1912 witnessed the greatest sustained establishment of new homesteads in Canada with an average of over forty thousand per year. It was during these years that the short-grass plains area between Moose Jaw and Calgary, the driest part of the Prairie Provinces, was thrown open for homesteading and pre-emption. The entire area was quickly occupied.

TABLE II

Population of the Prairie Provinces and the Percentage of Rural to Total Population 1901 to 1951

—	Mani- toba	Saskat- chewan	Alberta	Total	Rural Popula- tion as Percent of Total.
1901	255,211	91,279	73,022	419,512	75
1906	365,688	257,763	185,195	808,646	70
1911	461,394	492,432	374,295	1,328,121	65
1916	553,860	647,835	496,442	1,698,137	64
1921	610,118	757,510	588,454	1,956,082	64
1926	639,056	820,738	607,599	2,067,393	64
1931	700,139	921,785	731,605	2,353,529	62
1936	711,216	931,547	772,782	2,415,545	64
1941	729,744	895,992	796,169	2,421,905	62
1946	726,923	832,688	795,007	2,362,941	57
1951	776,541	831,728	939,501	2,547,770	*

* Not available

Source: Dominion Bureau of Statistics, *Census Reports*.

4. *Agricultural Occupation of Western Lands.*—Table III sketches the main outlines of the agricultural occupation of the Canadian plains after 1900 in terms of numbers, size and state of improvement of farm units. The rate of settlement and land improvement was particularly rapid from 1901 to 1911 but remained high until 1931. The period from 1921 to 1926 merits passing comment in that it witnessed a decline in the number of farms and but a slight increase in the area of occupied farms and of improved land. This was the first instance of widespread retrenchment in the prairie wheat economy and it will be considered in greater detail at a later stage of this analysis. The shrinkage in the number of farms during this period was more than compensated for

TABLE III

Number and Area of Farms and Acreage Under Field Crops in the Prairie Provinces, 1901 to 1951

	Number of Farms (Thousands)	Area of Occupied Farms (Millions of acres)	Average Size of Farm			Area of Improved Land (Millions of acres)	Area Under Field Crops (Millions of acres)
			Manitoba (acres)	Saskatchewan (acres)	Alberta (acres)		
1901.....	55.2	15.4	274.2	285.1	288.6	5.6	3.6
1906*.....							
1911.....	199.2	57.7	279.3	295.7	286.5	23.0	17.7
1916.....	218.6	73.3	288.5	353.8	339.3	34.3	24.6
1921.....	255.6	87.9	274.5	368.5	353.1	44.9	32.2
1926.....	248.2	88.9	270.6	390.1	370.5	49.3	35.0
1931.....	288.1	109.8	279.2	407.9	400.1	59.7	39.9
1936.....	300.5	113.1	271.4	399.6	405.2	60.9	40.2
1941.....	296.5	120.2	291.1	432.3	433.9	65.5	38.4
1946.....	269.7	117.6	306.2	473.0	462.9	65.4	41.7
1951†.....	248.7.†	123.9	*	*	*	*	43.4

* Not available.

† Preliminary.

‡ Not directly comparable with previous data due to change of definition.

Source: Dominion Bureau of Statistics, *Census Reports*.

by an increase in the average size of those remaining. This is made clear by the fact that the area of occupied farms did not decline during the five-year interval. Nevertheless there was also considerable farm abandonment during the period, particularly in eastern Alberta and south-western Saskatchewan. The number of farms in the Prairie Provinces reached a maximum of three hundred thousand in 1936 and consolidation of holdings by lease and purchase into larger units has reduced the number appreciably since that time.

The increase in the size of the average farm as indicated in Table III is particularly noticeable in Alberta and Saskatchewan. Obviously the data given in the table are the result of arithmetic calculation and do not

purport to represent typical farms. Farm units in the Prairie Provinces consist of one or more quarter sections of land of 160 acres each. They exist therefore as units made up of multiples of 160 acres, such as 320, 480 or 640 acres and so on without limit. More will be said later about the change in prairie farm sizes and about the geographic distribution of the various typical sizes. The persistent and continuing tendency toward larger farm units in Saskatchewan and Alberta is nevertheless clearly indicated in Table III.

Cultivated acreage on the prairie farms was used by the settlers almost wholly for wheat as the cash crop and for coarse grains to be fed to livestock on the farms. Tractors

were of relatively little importance until the inter-war years and meanwhile horses were necessarily used for power with the resultant requirement that a part of the farm acreage be utilized in the production of feed. Beef and dairy cattle and hogs were of consider-

tically all in the Prairie Provinces and all spring sown) increased from 4.3 million acres in 1901 to 11.1 million in 1911, to 23.3 million in 1921 and 26.4 million in 1931. Wheat shipments abroad increased from small amounts in the eighteen-nineties

TABLE IV

*Percentages of Prairie Field-Crop Acreages in Wheat, Oats and Barley,
1901 to 1931*

	1900	1906	1911	1916	1921	1926	1931
<i>Manitoba</i>							
Wheat.....	71.3	64.5	60.0	53.3	48.1	33.3	36.3
Oats.....	20.8	22.1	25.3	28.2	30.6	26.4	22.6
Barley.....	5.1	8.0	8.7	13.4	14.1	28.1	30.1
<i>Saskatchewan</i>							
Wheat.....	74.3	64.7	57.5	64.6	65.6	69.3	65.4
Oats.....	21.6	27.6	25.5	27.1	27.3	20.0	16.9
Barley.....	1.8	2.4	3.0	2.6	2.4	4.5	8.2
<i>Alberta</i>							
Wheat.....	22.8	24.4	48.5	47.3	57.3	67.2	66.7
Oats.....	62.5	51.9	36.1	38.6	29.9	20.9	18.2
Barley.....	5.9	11.8	4.9	6.1	4.6	4.5	5.9

Source: Table prepared by K. A. H. Buckley. See his unpublished Ph.D. thesis, *Real Investment in Canada* (University of London, 1950).

able importance in certain areas but for the most part did not appreciably affect the allocation of cultivated acreage. Table IV indicates the degree of specialization on prairie farms and its variability from province to province.

Increased wheat acreage provided the real basis of prairie agricultural and economic expansion. Canadian wheat plantings (prac-

till by the end of the first world war they were the largest single Canadian export in terms of dollar value. Wheat and flour exports yielded \$10.9 million in 1901, \$377.5 million in 1921 and \$495 million in 1929. Canada exported more than a million bushels of wheat a day on the average in 1929.

TABLE V

*Production of Wheat in the Prairie Provinces and Canada,
1871 to 1951*

—	Prairie Provinces			Canada
	Wheat Acreage (Millions)	Yield per acre (bushels)	Output (Millions of bushels)	Output (Millions of Bushels)
1871	.....	.....	.....	16.7
1881	.....	.....	.....	32.4
1891	.....	.....	.....	42.2
1901	.....	.....	.....	55.6
1911	10.0	20.8	208.4	230.1
1921	22.2	12.6	280.1	300.9
1925	19.8	18.2	367.1	395.5
1926	21.8	17.5	380.8	407.1
1927	21.4	21.2	454.6	480.0
1928	23.2	23.5	544.6	566.7
1929	24.3	11.6	281.7	304.5
1930	24.8	16.0	397.3	420.7
1931	25.6	11.8	301.2	321.3
1932	26.4	16.0	423.0	443.1
1933	25.2	10.4	263.0	282.0
1934	23.3	11.3	263.8	275.8
1935	23.3	11.3	264.1	281.9
1936	24.8	8.1	202.0	219.2
1937	24.6	6.4	156.8	180.2
1938	25.0	13.5	336.0	360.0
1939	25.8	19.1	494.0	520.6
1940	27.7	18.5	513.8	540.2
1941	21.1	13.9	296.0	314.8
1942	20.7	25.6	529.0	556.7
1943	16.1	16.6	267.8	284.5
1944	22.4	17.5	391.7	416.6
1945	22.6	13.1	294.6	318.5
1946	23.7	16.6	393.0	413.7
1947	23.4	13.7	320.0	341.8
1948	22.8	15.6	356.0	386.3
1949	26.5	12.7	337.0	371.4
1950	25.8	17.6	455.0	461.7
1951	24.6*	21.6*	531.0*	562.4*

* Preliminary estimate.

Source: *Grain Trade Year Book*, Sanford Evans Statistical Service, Winnipeg, and *Quarterly Bulletin of Agricultural Statistics*, Dominion Bureau of Statistics.

5. *Delay in the Occupation of the Short-grass Plains.*—We have spoken in general terms of the period from 1900 to 1930 as the period in which the Canadian wheat economy was established. The spread of settlement was, however, by no means uniform throughout the thirty-year period either regionally or in total. It has already been indicated that the major influx of migration into Canada and the most intensive period of homesteading and settlement in the Prairie Provinces were completed by the early years of the first world war. After 1926 there was another and rather less pronounced peak in immigration and western settlement, the latter particularly in the Peace River area in Alberta. There was also, however, a significant regional pattern evident in the spread of settlement in the earlier period of intensive activity, up to the early days of the war.

We have noted earlier that Hind recognized gradations of aridity within the overall "infertile triangle" as defined by Palliser. He really distinguished, without emphasizing the distinction, a drier triangle within the dry triangle. This exceptionally dry area, according to his observation, lay west of the Missouri Coteau and comprised the plateau stretching westward to the foot-hills of the Rocky Mountains. In terms of present-day landmarks this dry belt comprises the territory from Moose Jaw to Calgary, approximately, and extending from a broad base on the international boundary northward beyond the valley of the South Saskatchewan river. In general it comprises the drainage basin of the South Saskatchewan with its tributaries as far down as the Elbow. It is generally called the third prairie steppe in Canadian topographic terminology. It

might also be described as the Canadian extension of the Missouri plateau, lying as it does beyond the upper level of the modified escarpment of the Missouri Coteau. This drier triangle within a triangle constitutes the short-grass plains proper, its soil is generally light brown to brown signifying comparatively little accumulation of humus, and within its margins there are areas where average annual rainfall exceeds only slightly the ten-inch minimum which may be regarded as marking the margin between true aridity and semi-aridity.

There are a variety of reasons why more attention should be accorded this subdivision of the Prairie Provinces than is ordinarily given in analyses which treat the Prairie Provinces and the wheat economy as homogeneous units. The closer approach to aridity within this area than in other parts of the wheat growing region of the West is obviously of basic importance. This area comprises within its boundaries the irrigated parts of the Prairie Provinces as well as those territories in which additional irrigation is proposed. All of the various proposals for the development of irrigation projects on the South Saskatchewan or its tributaries are directed toward the application of river water on lands within, or on the northern and eastern margins of this region. One year or period of years with another, this area has raised an exceptionally heavy proportion of the problems that arise in the wheat economy. Finally, this area was the last to be occupied by farmer settlers and parts of it were soon abandoned. The abandoned parts, and others where settlers have clung tenaciously to their holdings under nearly im-

possible conditions, might better never have been occupied for purposes of cultivation.

By 1900 the geographic pattern of western settlement was already apparent in outline. The spread of occupation westward out of the Red River valley, through the Brandon plains and up the valleys of the Assiniboine and Souris rivers might suggest that succeeding waves of settlers would occupy the plains by a steady westward advance of the agricultural frontier until the Rocky Mountains were reached. There was already, however, a considerable band of settlement down the western margins of the plains from Edmonton through Calgary and Macleod to the boundary. There was also a pocket of settlement extending from the forks of the North and South Saskatchewan Rivers up the diverging valleys of these rivers for a hundred miles or so. There was already, therefore, a clear suggestion that newcomers preferred the "fertile" area or park belt and were not yet ready to strike out into the short grass plains for farming operations.

The comparatively heavy movement of settlers in the first six or eight years of the new century confirmed the earlier intimations of settlers' regional preference. Maps prepared from the data of the 1906 Census³⁰ show the short grass plains entirely surrounded on the east, north and west by a strip of agricultural settlement. Palliser's "fertile belt" was already wholly occupied, not necessarily exhaustively but with a spread of settlement which completely surrounded the short-grass plains.

6. *Re-Introduction of the Pre-emption Principle.*—In 1908 the Dominion Lands Act was significantly amended to re-introduce

³⁰ See W. A. Mackintosh, *Prairie Settlement: The Geographical Setting* (Toronto, 1934) p. 50.

the pre-emption principle into the Canadian land-grant system.³¹ According to this principle as embodied in the Canadian homestead scheme, the homesteader could "pre-empt" a quarter section of land adjoining his homestead quarter for purchase from the government at \$3 per acre. The pre-emption was to be paid for, one-third within the first three years following the homestead entry and the balance in five equal annual instalments. The pre-emption quarter was subject to improvement and residence requirements similar to those for the homestead, so that the settler was required to cultivate 50 acres of land in addition to his homestead requirements and was to live either upon his homestead or pre-emption quarter of land "for at least six months in each of the six years subsequent to the date of entry of his homestead".

The re-introduction of the pre-emption privilege in 1908 was double-barrelled in purpose. On the one hand it represented the final liquidation of the prior claim which railway land grants had formerly had upon the odd-numbered sections throughout the West. Within the pre-emption area as defined in the legislation of 1908, and as prescribed in a following paragraph, railways, particularly the Canadian Pacific Railway whose main line traversed the area, had selected only negligible amounts of their earned grants. Throughout the area the odd-numbered sections were by the new legislation to be available for homestead entry or for pre-emption sale by the government. These lands were nevertheless still expected to further the process of railway

construction, for the government committed itself by the legislation of 1908 to apply the proceeds from the sale of pre-emptions to the completion of the Hudson Bay Railway.

The other purpose of the new pre-emption measure was the extension of homestead settlement throughout the remainder of the prairie plains. Even in the more humid portions of the West it had become evident that a 160-acre farm was generally a less suitable unit than one of 320 acres. The homestead provided 160 acres only. The railways, however, had selected their land grants from the odd-numbered sections in the more humid regions, and the settlers in these areas therefore had railway lands adjacent to their homesteads available for purchase in order to enlarge their holdings. West of Moose Jaw the railways had not made any widespread selection of lands, regarding the entire regions as generally unfit for settlement. The proposal of the Dominion Government in 1908 was therefore to throw this area open for settlement, retaining the standard 160-acre homestead unit but offering the odd-numbered, as well as the even-numbered sections for homestead entry or for sale in quarter-section pre-emptions as described above. In this way the settler on the short-grass plains could normally start with a half-section instead of a quarter-section farm, the larger acreage being demonstrably even more essential for the purpose of securing a livelihood in the drier prairie areas than in the more humid parts of the West.

The pre-emption area established by the legislation of 1908 extended from Moose Jaw on the east to Calgary on the west, and from

³¹ The pre-emption principle had been incorporated in Dominion Lands legislation in 1874 but had been removed in 1894 because it contributed so obviously to

land speculation and so negligibly to stable settlement. Cf. Morton and Martin, *History of Prairie Settlement*, pp. 417 ff.

Battleford on the north to the international boundary on the south. There were substantial sections within these boundaries, particularly along the west and north, where the pre-emption privileges did not apply to specific townships because in these townships "eight sections or more had been accepted by any railway company as part of its land grant."³² It was estimated that approximately 28 million acres remained available for disposal under the new legislation.

The pre-emption area was thrown open for settlement in 1909. The succeeding few years, with the exception of 1910, brought better than average moisture conditions in the area and increasingly favourable cost-price relationships for wheat growers in general. Land agencies were established in the newly-opened territory and their personnel actively promoted the homestead process. Railway building was extensive in the region at the same time. The Canadian Pacific Railway built a "south line" roughly parallel to, and half way between, the main line and the international boundary. This line ran west from Weyburn on the "Soo" line of the C.P.R. for some three hundred miles, while another line was built eastward from Raymond on the Lethbridge line of the C.P.R. to meet it. The C.P.R. also built branches south-east and north-west from Swift Current. The Canadian Northern built south-west from Moose Jaw. Some 860 miles of railway were built south of the South Saskatchewan river in the five-year period after 1910. Railway construction opened the new territory to the settler and provided cash income to ease the financial burden of settlement. In this multiple coin-

cidence of exceptionally favourable circumstances the over-all occupation of the driest portions of the semi-arid western Canadian plains was quickly accomplished, for the most part within the period from 1909 to 1914.

7. *Population Trends in the Inner Triangle.*—The heart of the semi-arid plains, the "inner triangle", if we may so describe it, can be roughly identified in relation to a certain number of the federal census divisions. These are Divisions 2, 3, 4, 7, 8, 12 and 13 in Saskatchewan and 1, 3, 5 and 7 in Alberta. (See map). An analysis of the census data for these districts as a group reveals important features of the development of the area which they cover (see Table VI).

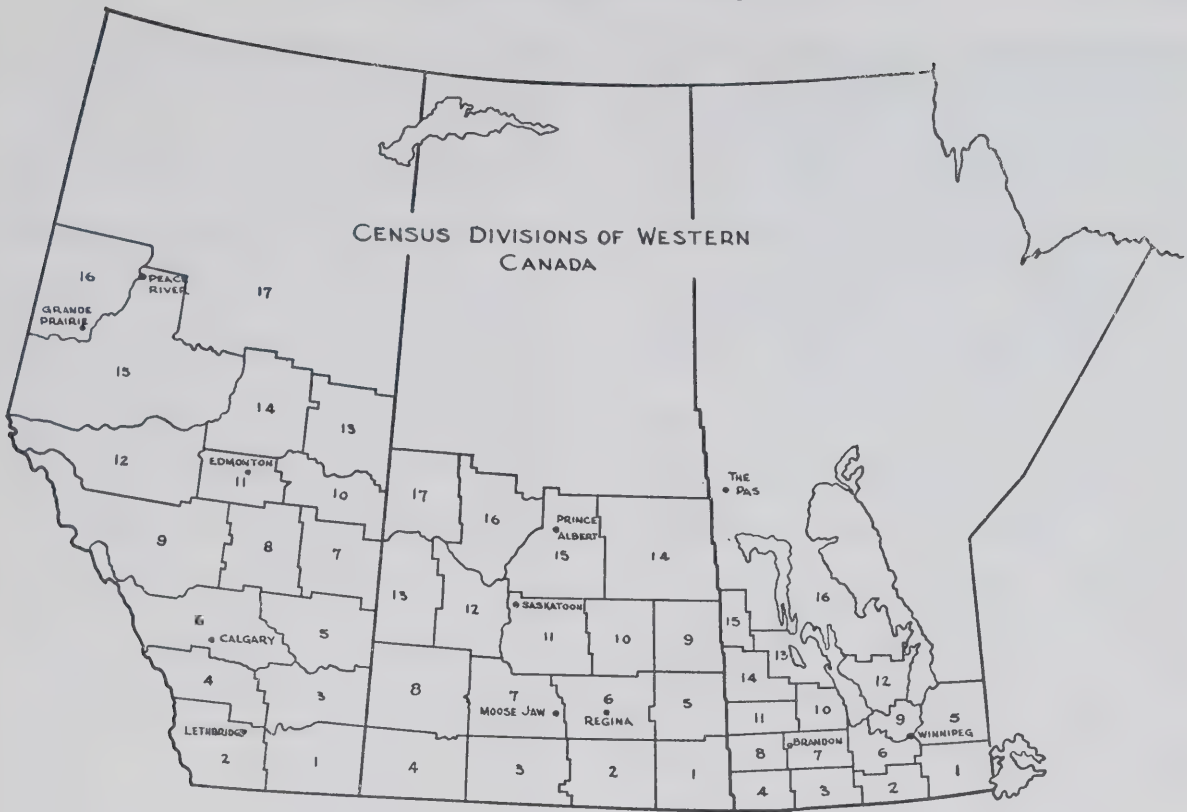
TABLE VI

Population in a Group of Census Divisions in South-Western Saskatchewan and South-Eastern Alberta 1901 to 1951

—	Census Divisions 2, 3, 4, 7, 8, 12 and 13 in Saskatchewan	Census Divisions 1, 3, 5 and 7 in Alberta	Total for Census Divisions Listed
1901.....	8,253	3,556	11,809
1906.....	52,505	13,779	66,284
1911.....	153,908	69,345	223,253
1916.....	243,874	98,574	342,448
1921.....	275,980	118,930	394,910
1926.....	296,096	98,433	394,529
1931.....	313,673	108,672	422,345
1936.....	288,845	103,447	392,292
1941.....	264,804	97,324	362,128
1946.....	239,589	92,652	332,241
1951.....	225,131	101,474	326,605

Source: Dominion Bureau of Statistics, *Census Reports*.

³² Cf. Morton and Martin, *History of Prairie Settlement*, p. 419, and for a map of this area see *ibid.*, p. 421.



These data show clearly the rapid rate of settlement in this central area after 1901. The whole area had less than twelve thousand inhabitants at the turn of the century. Particular census districts, notably those situated around the east and north of this inner triangle, had experienced heavy influxes of settlement by 1906. The region as a whole thus had a considerable increase in population over this five-year period but substantial blocks in the middle of the zone remained almost entirely vacant. By 1911 the pre-emption law had been in effect for two years and the settlement which took place in accordance with its terms is clearly evident in the population data for that year.

Settlement, moving in from the east, the north, the west and the south-west in a steadily shortening arc, had finally converged at one and the same time upon the centre and the driest parts of the semi-arid plains. The population increased from less than twelve thousand in 1901 to 66,000 in 1906, to 223,000 in 1911, to 342,000 in 1916 and 395,000 in 1921.

8. *Relationship between the American and the Canadian Frontiers.*—The point is frequently made that the occupation of the Canadian plains relied heavily on techniques and equipment which had been gradually evolved by the Americans in their mastery of similar areas to the south of the inter-

national boundary. The substantial validity of this contention is beyond dispute. The chilled-steel plow which was developed in the United States was indispensable for the breaking of the Canadian prairies. The self-binding reaper was perfected in the American middle west. Other implements of particular usefulness in the Canadian prairie region had been adapted to the agriculture of the plains by a generation or two of American experience. The steel windmill and barbed wire fence were American adaptations to the agricultural demands encountered in a region with a scarcity of water and a complete absence of wood for fencing materials. Americans constituted a large proportion of the settlers in the Canadian west. They brought with them the methods and equipment with which they had already had experience west of the Mississippi. Granted all this, it remains true that the wheat varieties which mastered the Canadian plains—Red Fife and Marquis—were Canadian varieties, the first by chance importation into Upper Canada in the eighteen-forties and the second by breeding and selection. It is also true that the practice of summer-fallowing as a means of moisture conservation, whether familiar to the Americans or not, was developed and popularized in the Canadian west in relation to specific Canadian requirements.

It will serve no useful purpose to argue over what the Americans did or did not contribute to the agricultural technology of the Canadian wheat economy. There is no point in attempting to belittle their very significant contribution. There is, however, a

much more fundamental qualification to be made to the customary analysis of the subject.

The commonly accepted assertion is that the American agricultural frontier of free land was exhausted by 1890 and that immigrant and American settlers turned to the Canadian north-west in the succeeding decades. The implication is that American settlers had occupied in closely consecutive stages the humid, the sub-humid and, finally, the semi-arid American plains by 1890, roughly to the same extent that the Canadian plains were occupied by 1916 or 1921. The further implication is that American settlers had developed techniques for the establishment of a wheat economy under the varying conditions encountered in each of these types of regions before they moved over to occupy the corresponding regions in Canada. This general approach is in part incompatible with the fact that the heaviest phase of homesteading in Montana and Alberta occurred simultaneously, in the years from 1909 to 1911. The common assumptions concerning the consecutive nature of American and Canadian prairie settlement apparently require modification.

A proper statement of the inter-relationship between settlement in the American and Canadian plains calls for emphasis upon the distinction between sub-humid and semi-arid regions. We have called attention to this distinction in relation to the Canadian west and have stressed the fact that the semi-arid areas in southern Saskatchewan and Alberta were not settled until after 1908, at which time the sub-humid and more "fertile" park

belt surrounding the drier central plains had been generally occupied. Similar stages of occupation are observable in American experience and they were not completed by 1890, nor were they closely consecutive as has been commonly assumed.

In general terms the frontier of free land which was exhausted in the United States by 1890 was on the margin between the sub-humid and the semi-arid regions. At that time comparatively little sub-humid land remained available for settlement in the American west. At the same date, however, comparatively little semi-arid land had as yet been settled upon. The current verdict was that the moisture conditions which characterized a semi-arid territory were by no means adequate for cereal production. Settlement moved out onto the semi-arid American plains, the "high plains", at the end of the first decade of the twentieth century at the same time that the movement took place onto the semi-arid Canadian plains. A series of years of better than average rainfall conditions, coupled with an improved cost-price relationship in wheat growers' markets, encouraged the movement in both cases. The driving imperative, however, was a widespread and apparently insatiable land hunger which persisted despite the exhaustion of the better settlement prospects in both the United States and Canada.

9. *Crop Experience on the Canadian Short-grass Plain.*—Neither the Americans nor the other immigrants who settled in the driest parts of the Canadian west after 1908 had the mastery of methods of cultivation which were adequate to the long-run require-

ments of such a region. The year 1910 was a dry year but it was followed by three years of satisfactory rainfall conditions. The year 1914 was one of drought with almost complete crop failure in many areas in Saskatchewan and Alberta. This was followed, however, by the fabulous year of 1915 when rainfall and other climatic conditions combined to produce a crop which was known in the west until 1928 as *the bumper crop* and which is still regarded by many an old-timer as the finest wheat crop ever grown in Canada. Rainfall was abundant in 1916 but the quality of the crop was impaired by rust. In 1917 the moisture conditions varied widely from place to place, being adequate in certain areas and quite inadequate in others. The next four years formed a period of widespread and persistent drought and for substantial portions of the Canadian semi-arid plains this meant five crop failures in a row, 1917 to 1921 inclusive.

Table VII records the specific crop results referred to in the preceding paragraph and illustrates the high degree of variability of crop production from year to year at specific sample points in south-eastern Alberta and in south-western Saskatchewan.

10. *Agricultural Investigations in Saskatchewan and Alberta, 1920-21.*—Agricultural conditions had become so serious throughout the short-grass plains of Saskatchewan and Alberta by 1920 that the provincial governments undertook to investigate in an attempt to discover causes and remedies. The Saskatchewan government convened a "Better Farming Conference" in Swift Current in July, 1920. Shortly there-

TABLE VII
Wheat Yields in the Semi-Arid Zone
(bushels per acre)

	Leth- bridge	Medicine Hat	Sounding Creek	South- western Saskat- chewan
1905	9.4	15.9	.....	.....
1906	21.8	18.7	.....	.....
1907	21.3	11.4	.....	.....
1908	20.7	7.7	.....	.....
1909	19.8	22.8	.....	.....
1910	6.8	7.0	.....	.....
1911	20.7	18.2	.....	.....
1912	16.7	15.6	.....	.....
1913	18.6	11.1	17.9	.....
1914	6.3	3.2	8.9	.....
1915	43.6	37.5	40.4	.....
1916	34.7	23.3	29.1	18.1
1917	.....	20.0	18.0	12.2
1918	7.1	3.0	5.4	4.7
1919	5.2	2.4	5.5	3.5
1920	13.0	7.7	15.7	9.9
1921	9.8	7.2	7.9	8.6
1922	18.5	9.3	6.7	18.7
1923	32.8	22.5	20.8	16.7
1924	17.0	6.0	6.0	6.8
1925	18.9	8.9	10.0	9.8
1926	20.0	9.0	9.0	8.8
1927	29.6	30.4	26.4	26.9
1928	27.1	28.6	22.8	27.1
1929	18.5	12.7	5.5	13.2
1930	21.1	9.9	.....	13.1

Source: Reproduced with kind permission of the author and publisher from W. A. Mackintosh, *Prairie Settlement: The Geographical Setting*, (Toronto, The Macmillan Co., 1934), p. 128.

after they appointed a royal commission to inquire into farming conditions in the south-western part of the province. In 1921 the Alberta Government appointed a survey

board for the investigation of agricultural conditions in the southern part of the province.³³ There is no point in giving any detailed outline of the findings of these bodies. They did not, in fact, present the conditions in any statistical frame of reference which might serve as a summary of the situation. One or two of the points which these groups developed in their reports are, however, worthy of comment in historical perspective.

The most important point which showed up in these analyses concerned the practice of summer-fallowing and its results within the drier portions of the plains area. Within these regions it was clear that soil conservation measures were more necessary than in any other part of the west. Summer-fallow was the great moisture-conserving device and was therefore absolutely indispensable in the dry areas. But here was the dilemma: summer-fallow could conserve moisture only if moisture existed, and during a succession of dry years such as were currently being experienced the rainfall was inadequate even for proper summer-fallowing practice. The cultivation which created the "black" or weed-free summer-fallow with its surface "dust mulch" created at the same time the ideal conditions for soil drifting. By 1920 this destructive condition was firmly established in certain parts of south-western Saskatchewan and eastern Alberta and was a menace which threatened to engulf much larger areas. The Saskatchewan royal commission of 1920 outlined the problem under

³³ Cf. *Report of the Survey Board for Southern Alberta* (Edmonton, 1922); *Report of the Royal Commission of Inquiry into Farming Conditions* (Regina,

1921); *"Progress Report on the Manitoba Agricultural Survey, 1921," and Some of the Charts and Maps Accompanying the Progress Reports on the Manitoba Agricultural Survey, 1921* (Winnipeg, 1921).

the heading, "Tillage Methods in Vogue in Southwest Saskatchewan and Resulting Conditions". They said in part: ³⁴

The "summerfallow" method of using the precipitation of three years to grow two crops, or of two years to grow one crop, has made possible the growing of grain in areas in which it is doubtful whether any other system of tillage and cropping would have produced equally good results. To "summerfallow" has meant to plow the land late in May or early in June and keep it free from vegetation during the remainder of the year so that what rain falls on it is absorbed by it and a considerable portion retained as a surplus for the next year's crop The early efforts of the homesteader have to do with breaking up the prairie and destroying native vegetation so as to have a place in which to grow crops. Soon, however, he has to consider what is the most profitable method of treating stubble land, and this introduces the summerfallow and with it come some of the problems of the summerfallow.

For over thirty years, the summerfallow once in three years has been the practice upon which successful grain growing has been carried on in Eastern and Central Saskatchewan. Until this plan of storing moisture was devised, crop failure was as frequent and just as serious in the eastern part of the province as it is now in the southwest. But while it stabilized grain growing it was learned that when the root fibres of the native prairie plants had been worked out or destroyed by frequent plowing and cultivating, the land developed a tendency to blow and drift, and this has been the history of most open plains districts where grain growing has been carried on for a dozen years or so, while some have reached this stage much sooner. The southwest being more recently settled than any other part of Saskatchewan should not yet experience soil drifting, but this has developed in some districts, and it may therefore be assumed that the soils which have already proved very troublesome in this respect are naturally deficient in fibre, and that provision will have to be made to restore organic matter if these

soils are to continue in use for grain production according to prevailing methods. Soil drifting is one of the most serious conditions in connection with grain growing on the lighter soils in Saskatchewan and calls for immediate action.

What the cure will be is not fully apparent

Both the Saskatchewan and the Alberta investigating groups made a variety of helpful suggestions for the improvement of agricultural practices in the dry zone. The Alberta survey board envisaged the extension of irrigation projects as the ultimate solution of all major difficulties throughout the Alberta section of the semi-arid plains. The Saskatchewan commission mentioned irrigation, but without enthusiasm. Both groups were greatly impressed with the apparent virtues of mixed farming. "The advantages of dairying", said the Saskatchewan commission,³⁵ "have never been better demonstrated than during the past three years when crops were poor and the income from grain growing slim and uncertain These men who had a few milch cows, a flock of hens, and a pig or two were immeasurably better off than those who had none of these to bring in a little money regularly to provide groceries and living necessities." "It is very remarkable", said the Alberta survey board ³⁶, "that, in practically every case . . . the farmer who has been consistently carrying a few head of milk cows, a few cattle, and a few hogs, and whose wife has been keeping poultry, is in a much better financial condi-

³⁴ *Report of the Royal Commission into Farming Conditions*, pp. 35-36. The same report (p. 35) described the method of breaking the prairie sod as follows: "The first tillage operation, however, is that of 'breaking' the prairie. Two methods are followed, namely deep breaking and shallow breaking, the latter being the first operation in 'backsetting'. 'Deep breaking' is taken to mean plowing to a depth of from four to five inches. When the furrow slice is sufficiently rotted that it can be disced without turning up unrotted sod, it is cultivated to make a good seed bed and to kill any remaining

vegetation. Shallow breaking means plowing to a depth of from two to four inches, leaving the sod flat to rot, and 'backsetting' or laying it over again by plowing a couple of inches below the sod so as to expose fresh soil to make a mellow seed bed. In districts where the sod is not grassy and is easily tilled, 'deep' breaking is the method commonly practised."

³⁵ *Ibid*, p. 36.

³⁶ *Report of the Survey Board for Southern Alberta*, p. 18.

tion than his neighbours And the very fact that he had to devote a certain amount of attention to these matters, helped to prevent his over-extending his cultural operations”.

The Saskatchewan commission transformed their admiration for mixed farming into a proposed program for the ultimate salvation of agriculture in southwestern Saskatchewan. They summarized their recommendations on this score as follows³⁷:

The foregoing may be briefly summed up as a suggestion for conducting a diversified farm on a rather small scale, providing for pasture and meadow facilities, keeping a limited amount of livestock to consume products otherwise unsaleable, such as forage, straw, drouth stricken or rusted sheaf grain, and providing for a limited amount of cash or market grain crops. The fundamental principle underlying the whole system is division of risk, provision for a large part of the food supplies on the farm itself, thus ensuring a degree of independence and freedom from debt not possible either in straight grain farming or stock ranching . . .

It will be a slower process than would follow a succession of years like 1915 and 1916, but it will be safer and surer, and will bring less worry and we believe less hardship, and more comfort and satisfaction than a system of grain farming alone.”

In retrospect we may note that diversified farming and the small farm unit have not been among the many modifications in cultural practices which, over the thirty-year period since the Saskatchewan and Alberta farming commissions reported, have offered an increasing prospect of successful farming operations in the semi-arid portions of the Prairie Provinces. Parts of this inner tri-

angle have been irrigated, parts have reverted to ranching or have been converted into community pastures. In the portions of the triangle which have persisted in cereal cultivation, however, there is greater specialization in wheat growing now than in 1920, and within the same area there has been the most persistent tendency toward the larger farm unit at the expense of the small.

11. *Agricultural Readjustment during the Nineteen-Twenties.*—The first half of the nineteen-twenties was a period of painful readjustment in the economic life of the region lying along the Alberta-Saskatchewan boundary³⁸. Some of the most striking of the indices of this readjustment are observable in a comparison of the census data for 1921 and 1926. The population of the inner triangle, made up of the census divisions as listed on page 104 above³⁹ and represented on the map on page 105, was practically the same in 1926 as it was in 1921. The total population of these census divisions was approximately three hundred and ninety-five thousand in 1921 and slightly less in 1926. This means that the heavy immigration of the ten or twelve years before 1921 had been reversed and converted into an exodus which, for the years 1921 to 1926, was of a magnitude equal to the entire natural increase in the area.

This, however, is the over-all picture for the region. The retreat from the land was much more pronounced in Alberta than in Saskatchewan. Of the seven Saskatchewan

³⁷ *Report of the Royal Commission into Farming Practices*, p. 59.

³⁸ The readjustment within this area was particularly severe because persistent crop-failure conditions were added to the general economic distress of the early inter-war years. All Canadian agricultural producers suffered from the precipitous decline of agricultural prices following the war and from the comparative

rigidity of the prices of goods and services required for farming operation and farm living. Debt burdens were particularly acute because such a substantial proportion of them had been incurred during the war years and on the basis of inflated property valuation.

³⁹ Census divisions 2, 3, 4, 7, 8, 12 and 13 in Saskatchewan and 1, 3, 5 and 7 in Alberta.

census divisions within the area all except one (number 7, west of Moose Jaw) had at least a slight increase of population during the five-year period, 1921 to 1926, and as a group their population increased by twenty thousand. The population within these divisions was thirty-two per cent of the total population of the province in 1921 and thirty-six per cent in 1926. In Alberta, on the other hand, all four of the census divisions included in the area declined absolutely in population. Division 3, comprising a large area north of Medicine Hat, declined by thirty per cent.⁴⁰ The four divisions as a group had approximately twenty thousand less residents in 1926 than in 1921. These four divisions contained almost twenty per cent of the total provincial population in 1921 but less than seventeen per cent in 1926.

Loss of population from the area under consideration here is more specifically related to agricultural failure if we take note of the farm abandonment associated with it. There were forty-nine hundred abandoned farms in Saskatchewan in 1926 but they were not

concentrated in any particular area except for a grouping of some nine hundred in census division number 8. At the same time there were one hundred and eighteen thousand and operating farms in the province and the proportion of abandonment may not be regarded as exceptionally high. In Alberta, however, the situation was more acute. With seventy-seven thousand operating farms in Alberta in 1926 there were ten thousand four hundred abandoned farm units. Over seventy-three hundred of these were concentrated within the four census divisions along the Saskatchewan boundary and five thousand of them were in divisions 3 and 5. Thirty per cent of the farm units in the four divisions were abandoned. In division number 3 over half the farm units and farm acreage were abandoned. The proportion was particularly high among the quarter section units and heavy as well for the half and three-quarter section units.

There is no need to describe in any detail the economic circumstances of the second half of the nineteen-twenties. Moisture conditions improved throughout the entire

⁴⁰ The Tilley East Area, covering approximately one million and a half acres, coincides roughly with the eastern half of census division number 3 in Alberta. It was the first of the Special Areas established by the Alberta Government to provide a settlement program which might correct the errors of homestead and pre-emption settlement in the driest part of the Canadian plains region. Farm and village residents and public agencies within the Tilley East Area were in such desperate financial circumstances by the middle 'twenties that the Alberta Legislature appointed a commission in 1926 to investigate and recommend corrective measures.

The commission reported that agricultural settlement had gradually displaced ranching in the area in the years immediately before and after 1910, that there had been few good crops except for those of 1915 and 1916, and that intolerable debt burdens had been accumulated. The commission found that at the peak there had been approximately 2,400 resident farmers in the district but that the number was already reduced and should be still further reduced. They pointed out that "a considerable percentage of the land alienated from the Crown in the right of the Dominion of Canada (was) passing to the

Crown in the right of the Province of Alberta through the failure of the owners to pay taxes levied against their lands, and that the claims registered against such lands were far in excess of their value." The commission recommended a complete cessation of land alienation in the area, the disorganization of existing municipalities and inactive school districts, and a consolidation and re-organization of settlement under a joint Dominion and provincial board. The province effected the recommendations of the commission in 1927, by *Statutes of Alberta*, 1927, c. 45. The joint board operated from 1929 to 1931 when, following the transfer of natural resources to the province, the Area came under the control of a provincial administrator in the Department of Municipal Affairs. By the early nineteen-thirties only approximately 500 farmers were in the Area as compared with the peak total of 2,400 a decade or so before. Cf. G. A. Elliot, "Problems of a Retrograde Area in Alberta", in W. A. Mackintosh, *Economic Problems in the Prairie Provinces* (Toronto, 1935, Appendix B pp. 291-4; also "Report of the Commission on the Tilley East Area," Province of Alberta, *Sessional Papers*, 1927, No. 20 (Edmonton, Queen's Printer).

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wheat economy. Good crops in the years 1925 to 1927 were followed by the "bumper" crop of 1928. Over the same period of years, price relationships were much more favourable to agricultural producers of all kinds than they had been in the first half of the decade. The wheat economy prospered again. Immigration revived and agricultural settlement moved northward in the Prairie Provinces with a particular regional concentration in the Peace River area in Alberta. Along with the new out-thrusting of the agricultural frontier went the customary complement of railway building and the mushroom growth of market centres. Approximately twenty-nine hundred miles of railway line were added in the Prairie Provinces between 1920 and 1930, with practically no increase in the mileage of any other part of Canada.⁴¹

The comparative prosperity of the later nineteen-twenties gave considerable impetus to the first major mechanical revolution to take place in the wheat economy. Table

TABLE VIII

*Number of Tractors, Harvester Combines and Motor Trucks
in the Prairie Provinces, 1921 to 1946.*

—	Tractors	Harvester Combines	Motor Trucks
1921	38,485	.....	.....
1926	50,136	.....	5,640
1931	81,659	8,897	21,517
1936	81,657	9,827	21,293
1941	112,624	18,081	43,363
1946	142,833	44,289	54,718

Source: Dominion Bureau of Statistics, *Census Reports*.

⁴¹ Of this mileage, 1,600 miles were added in Saskatchewan, 1,200 miles in Alberta and 100 in Manitoba. Cf.

VIII provides indices of this revolution in terms of tractors, trucks and harvester combines.

The gasoline tractor was well established in the West by the end of the first world war but its use became much more general in the later 'twenties. The harvester combine and the farm motor truck first appeared in significant numbers in the Canadian wheat economy after the middle of the decade.

IV. The Disastrous Decade, 1930-1939

1. *Introduction.*—The fulfilment of the national policy was symbolized in 1930 by the transfer of the natural resources in the Prairie Provinces to the provincial governments. The era of substantial settlement of new lands in western Canada was at an end. The lands in Manitoba had been declared to be "Dominion lands" by the Manitoba Act of 1870 and had been retained by the Dominion Government "for the purposes of the Dominion". These purposes—the construction of railways and the settlement of the West—were for the most part attained by 1920. It is true that a considerable additional mileage of branch line railways was built in the Prairie Provinces in the nineteen-twenties and there was a final flurry of new homestead settlement in the Peace River area after 1925. In general terms, however, the transfer of crown lands from the Dominion Government to the provinces merely awaited a solution of the difficult problem of determining an equitable financial adjustment. By 1930 this had been

Report of the Royal Commission on Dominion-Provincial Relations, Book I, p. 121n.

achieved and the transfer was effected. The transfer coincided with the commencement of a decade of unprecedented economic distress in the Canadian West.

The economic disaster which encompassed the wheat economy in the nineteen-thirties was compounded from the ill effects of world-wide depression and persistent local drought. Agricultural prices declined first and farthest of all price groups in typical response to depression influences. The drought which struck the American continental plains, and which enveloped the Canadian and American wheat economies alike, may have been no worse than the dry cycles of some previous periods. It was, however, the worst within the experience of the farmers of the day. Its impact upon western lands was of exceptional severity because of cultural practices which, ironically enough, had been adopted and pursued as a safeguard against the threat of drought. "Black" summer-fallow, carefully cultivated to destroy weed growth and thus to conserve moisture, was in a pulverized condition without fibre or structural resistance. Thus the top-soil drifted before the high regional winds over tremendous areas and destroyed crop prospects year after year by exposure of germinating seed or by erosion of young and easily injured seedlings.

2. *The Production Record.*—Turning first to consider the relevant production record we may show the significant facts most clearly by contrasting the data for the Prairie Provinces for the nineteen-thirties as compared with those for the nineteen-twenties.⁴² For the ten-year period 1920 to 1929 inclusive the Prairie Provinces had pro-

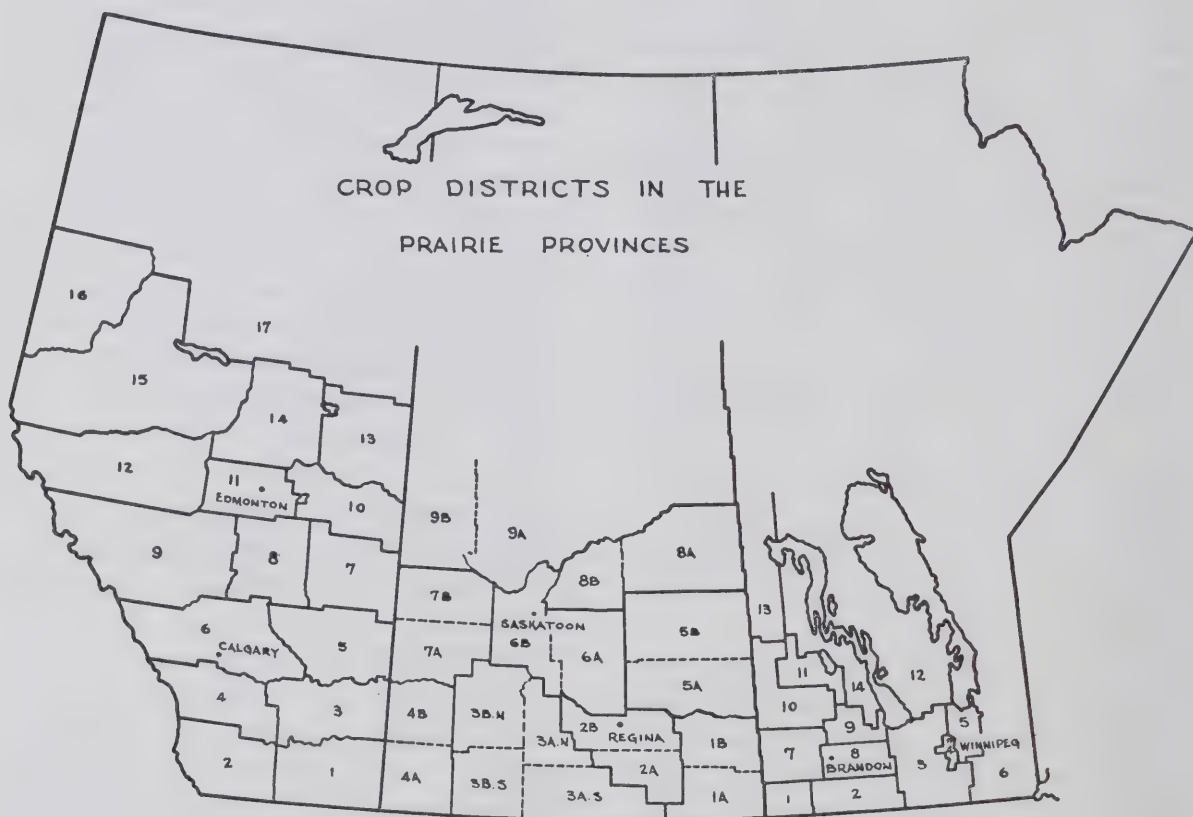
duced an average wheat crop of 360 million bushels per year representing an over-all average yield of 17 bushels per acre. The crop of 1928, which still ranks as one of the four or five "bumper" crops in the Canadian wheat economy, had averaged 23·5 bushels per acre and had totalled 545 million bushels. The average wheat crop throughout the nineteen-thirties was but 286 million bushels, representing an average yield per acre of 11·6 bushels. Over the five-year period from 1933 to 1937, inclusive, the average prairie wheat crop was but 230 million bushels and the average yield was only 9·5 bushels per acre. The year 1936 was worse than this average even. The average wheat yield this year was 8 bushels per acre and the total crop for the three Prairie Provinces was 202 million bushels. The year 1937, however, was by all odds the worst in the history of the Canadian West, with a total wheat crop of 157 million bushels and an over-all average yield of 6·4 bushels per acre.

Broad regional averages conceal wide variations in actual yield data from place to place, and five- or ten-year averages conceal sharp irregularities, taking one year with another. Table IX illustrates these points with reference to the Province of Saskatchewan. As shown in this table, the average wheat yield for Saskatchewan for the decade of the 'thirties was 10·3 bushels per acre. This average, however, embraces the extremes of annual data ranging from 2·6 bushels per acre for the 1937 crop to 17·6 bushels for that of 1939. Variations in the ten-year average yield data by crop districts ranged from 6·6 bushels in district number 3

⁴² See Table V, above.

to 18.5 in district number 8. Generally speaking the low yields for crop districts 1 to 4 are indicative of the climatic conditions throughout the short-grass plains for the entire decade. These four crop districts (cf. map) take in the entire southern part of the province below the valleys of the Qu'Appelle and South Saskatchewan Rivers, and comprise approximately one-half of the total wheat acreage of the province. In the total

dismal record as portrayed in Table IX, the year 1937 stands out only in degree of extremity. Even here the regional comparison is striking. With total crop failure prevalent throughout the south-western and central part of the province, nevertheless crop district number 8, lying well within the park belt, gathered a ten-bushel per acre wheat crop, the full equivalent of the provincial average for the decade.



Throughout the decade prairie farmers planted an average of twenty-four and three-quarter million acres of wheat a year. Actual

acres fell to a low of 23.3 million for each of the years 1934 and 1935, and increased to 25.8 for the year 1939.

TABLE IX

Average Yields of Wheat by Crop Districts in Saskatchewan and for the Province of Saskatchewan, 1930 to 1939.

Year	No. 1 South Eastern	No. 2 Regina- Weyburn	No. 3 South Central	No. 4 South Western	No. 5 East Central	No. 6 Central	No. 7 West Central	No. 8 North Eastern	No. 9 North Western	Province of Saskat- chewan
1930.....	13.9	11.2	8.4	13.7	16.0	10.9	19.9	24.1	29.3	14.4
1931.....	4.8	1.8	3.1	5.7	10.6	8.4	13.0	22.0	23.4	8.8
1932.....	11.9	11.0	8.3	15.7	17.2	11.6	16.9	22.0	20.7	13.6
1933.....	8.5	12.4	4.0	4.3	23.4	5.6	4.1	16.6	14.4	8.7
1934.....	4.8	4.8	3.6	4.3	18.1	8.2	8.6	16.7	18.1	8.6
1935.....	4.3	7.4	11.6	7.1	9.7	13.8	10.6	16.3	14.3	10.8
1936.....	5.7	9.1	4.4	1.2	16.5	9.8	5.0	13.4	7.7	7.5
1937.....	3.9	1.5	0.2	0.1	7.5	1.2	1.4	10.2	5.5	2.6
1938.....	8.2	10.1	7.0	9.9	15.2	9.3	11.7	13.8	9.0	10.0
1939.....	7.0	9.9	16.6	16.4	21.9	19.3	19.3	27.9	20.0	17.6
Ten-year average..	7.4	8.0	6.6	8.1	15.8	9.7	11.1	18.5	16.1	10.3

Source: Report of the Secretary of Statistics for the Fiscal Year April 30, 1940, Saskatchewan Department of Agriculture.

3. *The Price Record.*—Price experience during the nineteen-thirties was at least as devastating for the prairie farmer as was his production record. With many grades of wheat and many freight-rate zones it is only possible to give illustrative figures bearing on local farm prices. So startling are the contrasts, however, that even rough indices serve the purpose well. Table X shows the record of Wheat Pool payments for wheat for the crop years 1924-25 to 1928-29 inclusive. The prices are for No. 1 Northern in store at Fort William. The pools handled roughly one-half of the western wheat crop over the years represented in the table and it has not been clearly demonstrated that their price yields were appreciably out of line, either up or down, from any annual average

which could be regarded as more representative of reality for the years in question.

TABLE X

<i>Wheat Pool Payments, 1924-29</i> (basis No. 1 Northern, Fort William)	
<i>Crop Year</i>	<i>Payment per bushel of wheat</i>
1924-25	\$1.66
1925-26	1.45
1926-27	1.42
1927-28	1.42½
1928-29	1.18½

The data in Table X are introduced as giving a reasonable picture of the cash yield of western wheat throughout the latter half of the nineteen-twenties.

The Wheat Pools were not operative on a pooling basis throughout the 'thirties so

that it is not possible to project the data of Table X over the succeeding ten years. Reference to the Winnipeg price for No. 1 Northern wheat, basis Fort William, will however suggest the disaster of the price decline. The Winnipeg price for No. 1 Northern (in store at Fort William) fluctuated roughly between \$1.15 and \$1.30 per bushel throughout the latter half of 1928 and the early months of 1929. A sudden speculative flurry in the mid-summer of 1929 carried the price to a peak of \$1.78 $\frac{3}{4}$ in July and a high of \$1.73 $\frac{5}{8}$ in August. Thereafter, however, the decline was continuous and at times precipitous. By March of 1930 a low point of \$1.00 $\frac{7}{8}$ was momentarily reached. In June the price dropped below a dollar a bushel for the first time in fifteen years. In August, 1930, No. 1 Northern achieved a momentary high of \$1.00 $\frac{7}{8}$ and dollar wheat did not re-appear in Canada until July, 1936, a period of six years. The low point for the decade and for all-time Canadian experience was in December, 1932, when No. 1 Northern wheat sold in Winnipeg (in store at Fort William) for 39 $\frac{3}{8}$ cents per bushel. This would represent a farm price of approximately 20 cents. The annual average Winnipeg prices of No. 1 Northern for the decade were as follows:

1929-30	\$1.24 $\frac{1}{2}$
1930-31 .....	.64 $\frac{1}{2}$
1931-32 .....	.59 $\frac{5}{8}$
1932-33 .....	.54 $\frac{1}{2}$
1933-34 .....	.68 $\frac{3}{8}$
1934-35 .....	.81 $\frac{1}{2}$
1935-36 .....	.84 $\frac{5}{8}$
1936-37	1.22 $\frac{3}{8}$
1937-38	1.31 $\frac{1}{8}$
1938-39 .....	.62

The declines in the price of wheat during the early and middle 'thirties as indicated by the above data were far more severe than were the declines in the prices of goods and services necessary for farming operations. In terms of purchasing power, therefore, wheat—along with other farm produce—declined drastically. One careful estimate⁴³ places the purchasing power of a bushel of wheat at 49, 46, and 42 per cent of the 1913 figure for the years 1931, 1932, and 1933 respectively.

4. *Income, Relief and Debt.*—The combination of short crops and low prices described in the preceding paragraphs resulted in income effects of disastrous proportions. These circumstances are apparent from Tables XI and XII showing cash income data for Canada and the Prairie Provinces for the past twenty-five years. Table XI shows the gross cash income received from the sale of farm produce. Table XII shows *net* income but lumps unincorporated business along with farm enterprises.

High yields and high prices in the late nineteen-twenties had brought prosperity to the farmers of the Prairie Provinces. The average yearly income from the sale of farm products in the Prairie Provinces, for the years 1926 to 1929 inclusive, was \$543 million. The bumper crop of 1928, animal as well as cereal, had yielded well over six hundred million dollars. In sharp contrast to these results, prairie farmers derived an average cash income of but \$245 million per year for the entire decade from 1930 to 1939 inclusive, a figure substantially below half that of the later nineteen-twenties. The

⁴³ The Searle Grain Company, Limited, Winnipeg, compares the Searle Index of the cost of 147 items of groceries, clothing, household and farm equipment, farm machinery and municipal and school taxes with the index for the price of wheat.

cereal and livestock crops of 1931, 1932 and 1933 each yielded a bare \$175 million, or less than one-quarter of the yield of 1928.

TABLE XI

Cash Income from the Sale of Farm Products for Canada and the Prairie Provinces, 1926 to 1950.

(millions of dollars)

Year	Canada	Mani- toba	Saskat- chewan	Alberta	Prairie Prov- inces
1926	963	90	291	163	544
1927	941	80	271	170	521
1928	1,072	83	321	214	618
1929	936	74	245	171	490
1930	640	48	122	96	266
1931	450	31	71	71	173
1932	388	29	78	69	176
1933	402	32	77	69	178
1934	492	43	93	95	231
1935	519	36	108	98	242
1936	580	47	126	94	267
1937	640	75	84	121	280
1938	661	65	93	134	292
1939	717	65	158	120	343
1940	748	64	151	127	342
1941	896	82	162	147	391
1942	1,099	104	195	168	467
1943	1,407	146	328	221	695
1944	1,830	177	544	338	1,059
1945	1,695	153	410	288	851
1946	1,743	167	388	282	837
1947	1,967	182	428	340	950
1948	2,463	248	534	452	1,234
1949	2,495	243	561	460	1,264
1950	2,224	196	408	369	973

Source: Shefrin, Frank, *Farm Income: Cash and Net, 1926 to 1948* (Preliminary Report) Economics Division, Marketing Service, Department of Agriculture, Ottawa, Sept., 1949, p. 8: data for 1949 and 1950 by correspondence.

TABLE XII

Net Income Received by Farm Operators from Farm Production and Net Income of Non-Farm Unincorporated Business for Canada and the Prairie Provinces, 1926 to 1950.

(millions of dollars)

Year	Canada	Mani- toba	Saskat- chewan	Alberta	Prairie Provinces
1926	1,123	89	200	126	415
1927	1,166	56	208	171	435
1928	1,223	86	220	139	445
1929	1,015	58	89	91	238
1930	874	52	60	71	183
1931	573	19	-10	36	45
1932	464	26	15	33	74
1933	396	18	2	22	42
1934	519	31	13	52	96
1935	588	30	43	49	122
1936	619	38	30	39	107
1937	748	82	-13	87	156
1938	806	59	49	104	212
1939	899	60	125	92	277
1940	980	70	114	117	301
1941	1,118	90	94	102	286
1942	1,740	144	316	243	703
1943	1,599	147	200	150	497
1944	2,010	160	393	252	805
1945	1,841	133	230	190	553
1946	2,161	161	253	243	657
1947	2,350	189	304	282	775
1948	2,953	262	429	386	1,077
1949	2,969	232	441	362	1,035
1950	2,942	219	339	335	893

Source: *National Accounts, Income and Expenditure, 1926-50*, Dominion Bureau of Statistics, pp. 62-3.

The following table groups the cash income receipts into significant periods of years and shows the average per year within each period.

TABLE XIII

Average Annual Cash Income from the Sale of Farm Products in the Prairie Provinces, 1926-50

(millions of dollars)

1926-29 (4 years)	543.2
1930-34 (5 years)	204.8
1935-39 (5 years)	284.8
1940-45 (6 years)	634.0
1946-50 (5 years)	1051.6

Source: Calculated from data in Table XI.

The income position of prairie wheat growers in the nineteen-thirties was at the level of destitution and relief was required on an unprecedented scale in order to avert the most rigorous hardships. In the drought areas of the Prairie Provinces the repeated crop failures wiped out not only the livelihood but also the entire working capital of resident farmers. The relief requirement therefore was not only for food, fuel, clothing and shelter, as it was for the unemployed wage earner, but for seed, feed, fodder, tractor fuel and supplies as well.

The impact of these circumstances was worse in Saskatchewan than in any other province in the Dominion. Successive crop failures affected an area of crop land, concentrated for the most part in this province, equal to one-quarter of the total improved farm acreage in Canada. The drought area during the decade comprised the farms of approximately one-half of all Saskatchewan farmers. In 1931, one-half; in 1933, 1934 and 1936, one-third; and in 1937, two-thirds of the farm population of Saskatchewan was destitute.⁴⁴ As early as 1930, municipal and provincial financial resources proved

inadequate to the relief requirements of the drought areas in Saskatchewan. The Dominion Government assumed roughly one-half of the total burden by outright grant and for several years provided one hundred per cent of the total relief funds required, by way of grant, loan or bank guarantee. For the period from 1930 to 1937 inclusive, the relief burden amounted to three-fifths of the total ordinary revenues of the provincial and municipal governments of Saskatchewan compared with one-fifth for the rest of the country. In 1937 relief costs amounted to 163 per cent of provincial and municipal revenues in Saskatchewan.⁴⁵ Churches, welfare organizations and private individuals within and without the province contributed unstintingly to the alleviation of distress which paradoxically for an agricultural community, but none the less certainly, approached dangerously close to famine proportions.

The wheat economy suffered a tremendous set-back as a consequence of the disastrous years of the 'thirties.⁴⁶ The capital accumulated before 1930 was in considerable measure consumed thereafter. Farm buildings and equipment went into disrepair, as did those of the local market centres in almost equal measure. Private and public debt accumulated. Public services of all kinds throughout the Prairie Provinces avoided complete disorganization with the utmost difficulty. It was estimated that the total agricultural debt in Saskatchewan amounted to \$525 million as at December 31, 1936, and that a year later it stood at \$482 million or \$15 per acre of crop land despite

⁴⁴ *Report of the Royal Commission on Dominion-Provincial Relations*, Book I, p. 169.

⁴⁵ *Ibid.*, p. 170.

⁴⁶ For a thorough and sympathetic treatment of economic and social conditions in the central prairie province during the nineteen-thirties, see G. E. Britnell, *The Wheat Economy* (Toronto, 1939).

the cancellation of \$83 million in 1937 under debt adjustment legislation.⁴⁷ Estimates made for the Rowell-Sirois Commission placed the agricultural debt of the Prairie Provinces at \$806.3 million as at December 31, 1937.⁴⁸ Between 1930 and 1937 the total debt of the Saskatchewan provincial government was more than doubled, with three-fourths of the increase due to relief.⁴⁹ In 1929 the per capita dead-weight debt of the province was the lowest in Canada with the exception of Quebec; in 1937 it was the highest.⁵⁰

5. *Population Movements.*—The economic conditions of the nineteen-thirties led to a reversal of earlier population movements within the Canadian economy. The Prairie Provinces became an area of net emigration, providing a substantial flow of population to central Canada and to British Columbia. Within the Prairie Provinces themselves, population moved away from the short-grass plains, the most seriously drought-ridden areas, toward the park belt on the north and

TABLE XIV

*Population of the Prairie Provinces
1921 to 1941*

	1921	1926	1931	1936	1941
Manitoba....	610,118	639,056	700,139	711,216	729,744
Saskatchewan	757,510	820,738	921,785	931,547	895,992
Alberta.....	588,454	607,599	731,605	772,782	796,169
Prairie Provinces..	1,956,082	2,067,393	2,353,529	2,415,545	2,421,905

Source: *Eighth Census of Canada, 1941*, p. 3, and *Census of the Prairie Provinces, 1936*.

⁴⁷ A *Submission by the Government of Saskatchewan to the Royal Commission on Dominion-Provincial Relations* (Regina, 1937), p. 194.

⁴⁸ Waines, W. J., *Prairie Population Possibilities* p. 55.

TABLE XV

*Net Immigration into or Emigration from the Prairie Provinces, 1921-31, 1931-36, 1936-41**

—	1921-31	1931-36	1936-41
Total Increase in Population...	397,447	62,016	6,360
Natural Increase.....	356,729	165,442	150,779†
Net Immigration (+) or Emigration (−).....	+40,718	−103,426	−144,419

* Adapted from *The Interests of Western Canadian Agriculture in the Peace Settlements* (Midcontinent and the Peace, No. 2, Minneapolis, 1943, p. 9.

† Estimated.

east. Tables XIV and XV indicate significant population movements for the Prairie Provinces individually and as a group.

There were more people in the Prairie Provinces in 1941 than in 1931, but very few more than in 1936. In the five years after 1936 these provinces lost population equal to more than ninety-five per cent of their natural increase. Even between 1931 and 1936 there was a substantial net emigration from the three provinces. During the nineteen-thirties the Prairie Provinces provided a net emigration of close to a quarter of a million persons.

The loss of population from the Prairie Provinces as a group was accompanied by a pronounced internal migration. Many residents of the worst drought areas of Alberta and Saskatchewan in particular, and to a lesser extent, of Manitoba, migrated northward and northeastward, away from the short-grass plains to the circling park belt. The census divisions in the inner triangle along the Saskatchewan-Alberta

⁴⁹ *Report of the Royal Commission on Dominion-Provincial Relations*, Book I, p. 170.

⁵⁰ *Ibid.*

boundary lost particularly heavily. Whole census divisions in that area had only four residents in 1941 where there had been five in 1931. Census division number 5 in Alberta had little more than two-thirds the population in 1941 that it had in 1931. These, be it noted, are losses in absolute numbers and indicate total net emigration from the particular districts of numbers equal to total natural increase *plus* the declines recorded in census data.

The thinning out of population in the period of the nineteen-thirties was much more pronounced and widespread in Saskatchewan than in Alberta. The removal had occurred in Alberta in the five-year period from 1921 to 1926 following the four or five years of disastrous drought which had affected particularly the eastern part of that province at the end of the first world war.⁵¹ Between 1921 and 1926, census divisions 1, 3, 5 and 7 in Alberta, which blanket the eastern part of the province below the North Saskatchewan River, declined in population by 20,500 persons or by approximately 17 per cent of their 1921 total. South-western Saskatchewan had suffered throughout those years as well, and had experienced certain readjustments of population and farming practices in the first half of the nineteen-twenties. Nevertheless, throughout this earlier period of readjustment, which had been of such drastic magnitude for eastern Alberta, only two census districts in Saskatchewan (8 and 9) had registered any absolute loss of population. This decline had been of the order of twenty-five hundred or less than three per cent. The Alberta agricultural economy had been much more

thoroughly shaken down before 1931 than had that of Saskatchewan. The readjustment in the latter province was particularly acute thereafter.

Eleven census divisions in Saskatchewan (divisions 1-8, 11, 12, and 13) lost population absolutely between 1931 and 1941. Their absolute decline equalled 73,000 or approximately 12 per cent of the population in these divisions in 1931. These divisions as a group had two-thirds of the population of the province in 1931 and only 60 per cent of it in 1941. Meanwhile census divisions in the park belt portions of the province increased substantially in population. One division (number 14, running east from Melfort to the Manitoba boundary) increased from 46,222 to 65,166, or by 41 per cent.

6. *Rehabilitation.*—During the early nineteen-thirties the economic distress throughout the Prairie Provinces was so great and the various governmental agencies were so ill prepared to meet the situation that little long-run planning was possible. Problems were dealt with as they arose, on a day-to-day or year-to-year basis. It was a question of assuring relief rather than of planning rehabilitation. Toward the middle of the decade, although relief requirements abated little, the Dominion and provincial governments began to take the longer view and to formulate measures which would contribute to rehabilitation and not merely to temporary relief. Relief and rehabilitation became complementary purposes of the Dominion and provincial governments.

Most far-reaching of all the measures looking toward re-orientation of prairie agricul-

⁵¹ See Table VI, above.

ture was the institution of the Prairie Farm Rehabilitation Administration by the Dominion government in 1935.⁵²

This agency of the Dominion Department of Agriculture has since its inception gone far toward the formulation and implementation of a program for the improvement of prairie agriculture. In general terms this program has required action in three areas, those of cultural practice, land utilization, and water conservation.

The most critical problem which awaited the Administration on its establishment was that of widespread soil drifting or massive wind erosion. Millions of acres, entire regions in the short-grass areas, were rapidly becoming uninhabitable by virtue of this condition. This and many other problems as well as many variants of the problem of wind erosion have been dealt with in terms of cultural practices with a most encouraging measure of success. The demonstration and encouragement of such practices as the use of the plowless or trash-covered summer-fallow and of strip farming contributed to the restoration of a high proportion of the eroded land to effective cereal cultivation. Substantial acreages of the poorest lands were, however, permanently removed from cereal production, and large areas were re-grassed and individual holdings consolidated into community pastures. The community-pasture project, well under way before the end of the 'thirties, has continuously expanded until by 1951 more than eighty such pastures comprising over a million and a half acres of sub-marginal land had been established. These pastures provide grazing facilities for some seventy thousand head of

livestock belonging to six thousand farmers within reach of the respective pastures. Obviously the establishment of community pastures has involved much effort in the way of land classification and in the resettlement of resident farmers—this by way of correction of the worst of the mistakes of the original settlement movement.

The water conservation activities of the P.F.R.A. comprise "small" and "large" water development projects, the latter more recently sub-classified as "community" and "major" water development projects. Under the small water development program the P.F.R.A. has provided engineering and financial assistance toward the construction of upwards of fifty thousand small dams and dugouts for the conservation of spring run-off waters on individual farms. Large water development projects, whether of the community or of the major category, have been financed exclusively by P.F.R.A. or on an agreed Dominion-provincial basis. The major water development projects envisage the damming of rivers which cross the plains in order to control their flow for irrigation and power production. The completion of the St. Mary Dam in 1950 and the creation of the distributive system which has been in process since that time brings one of the major projects appreciably nearer to completion. The South Saskatchewan River Project is, of course, one of the remaining major water development possibilities which is still under review. In terms of rough perspective the P.F.R.A. river projects envisage of the possibility of placing two million acres of land "under the ditch" in

⁵² *Statutes of Canada*, 25-26 Geo. V (1935) c. 23.

addition to some six hundred and fifty thousand acres now in that category in the Prairie Provinces.

The P.F.R.A. was clearly designed to deal with production difficulties as a necessary step toward the restoration and maintenance of real agricultural income in the wheat economy. In addition to the establishment of this agency the Federal Government took steps in the 'thirties to deal more directly with the price and income hazards to which wheat growers are subject. The price stabilization operations carried on after 1930 by J. I. MacFarland with federal moneys gave way to a federal wheat board with an annual guaranteed minimum price for wheat after 1935. This agency served as an optional wheat-marketing channel until 1943 when the Canadian Wheat Board was given exclusive control over the marketing of Canadian wheat, a control which it has since retained. In 1939 the Prairie Farm Assistance Act⁵³ provided for annual grants to individual farmers under certain production and/or price conditions conforming to the legislative definition of a "national emergency" or a "crop failure year". The maximum grant to the individual farmer could not exceed \$500 in any year. Growers pay a levy of one per cent of the sale price of all wheat, oats, barley and rye which they market. Deficiencies are made up out of the Consolidated Revenue Fund. From 1939 to the end of the fiscal year 1950-51, total payments under the Prairie Farm Assistance Act had amounted to \$135 million and total receipts to \$52 million.

The federal government attempted to contribute toward the solution of the agricul-

tural debt problem in the Prairie Provinces by the enactment of the Farmers' Creditors Arrangement Act in 1934.⁵⁴

The provincial governments as well as the Dominion gradually came to combine rehabilitation with relief. The transfer of the natural resources to the Prairie Provinces in 1930 gave the governments of these provinces a much greater interest and responsibility in the matter of settlement and resettlement than they had had at any previous time. Alberta had already devised special legislation to deal with acute resettlement problems in one of the areas—the Tilley East Area—most severely affected by the drought in the early inter-war years. The Tilley East Area Act of 1927⁵⁵ established a joint Dominion-provincial board for the supervision of this area. The board began operations in 1929 but the Dominion interest in the matter was relinquished in 1931 after the transfer of natural resources to the provinces. The Board worked for a thorough reorganization of agricultural production in the Area. Settlers were moved from the worst of the land to better parcels within or, more commonly, without the district. Holdings were consolidated to provide private or community grazing leases. The Area was closed to further settlement and public facilities were abandoned or consolidated. In 1932 the special-areas type of approach was generalized in Alberta by the passing of the Special Areas Act, a land utilization act providing for a provincial board for the administration of existing special areas and for additional areas which it might be considered advisable to add.

⁵³ *Statutes of Canada*, 3 Geo. VI, (1939) c. 50. ⁵⁴ *Ibid*, 24-25 Geo. V (1934) c. 53. ⁵⁵ *Statutes of Alberta*, 1927, c. 45.

Saskatchewan faced the problems of re-settlement on a major scale for the first time after 1929. Considerable governmental assistance was given to the movement of families from unsuitable lands. In 1936 the government established a Land Utilization Board under provincial statute⁵⁶ which empowered the Board to withdraw land from cultivation and to control the use of grazing lands. These powers were modified and extended by later legislation. By the end of the decade it was estimated that upwards of 10,000 families had moved from the worst of the drought areas in southern Saskatchewan to new holdings in the wooded areas and park belt of the north.⁵⁷

7. *Summary.*—By the end of the nineteen-thirties considerable progress had been made toward a re-orientation of the prairie agricultural economy and the correction of the worst of the mistakes made in the unreasoning enthusiasm of the land-rush days. A decade of public and private effort had begun to show long-term results. Many thousands of individuals had suffered acutely, some irreparably. Land abandonment and resettlement are impersonal terms with tragic personal import. Human resources no less than other resources are subject to misuse, erosion and destruction.

The wheat economy exemplified all these processes in full measure in the 'thirties but by the end of the decade the most painful of the inevitable readjustments had been made. Lands had been abandoned or restored to grazing use, population had been thinned out and farm units had been enlarged. Methods of cereal cultivation had been

revolutionized. "Black" summer-fallow had made farming possible on the short-grass plains but had eventually come near to destroying the plains and the plains population as well. This type of summer-fallow had to be replaced but it was replaced by another type, the trash-covered summer-fallow, and not by no summer-fallow at all. The plow and disc harrow which buried all stubble and pulverized the top soil were replaced by the one-way disc, the rod weeder, the duck-foot cultivator and a considerable variety of other cultivators which individually or collectively left stubble and trash on or near the surface and left the surface in clods, lumps and ridges instead of in a floor of powder. Tractors replaced horses in increasing proportions, harvester combines became more plentiful and farm trucks more common (see Table VIII above). The development and introduction of rust resistant varieties of wheat in the middle 'thirties wiped out almost completely, for the immediate future at least, the greatest of all hazards to the wheat grower with the single exception of drought.

V. Effects of the Second World War on the Prairie Economy

1. *Wheat and Wartime Agricultural Policy.*—The outbreak of the second world war in 1939 came at a time when the prairie wheat economy had made significant beginnings in the processes of re-orientation of agricultural location and methods and some recovery from the economic difficulties of the preceding decade. Moisture conditions had improved in 1938 and 1939 and agricultural

⁵⁶ *Statutes of Saskatchewan*, 25 Geo. V, c. 62.

⁵⁷ Eisenhauer, E. E., "Land Utilization in Saskatchewan", *C.S.T.A. Review*, December 1939, p. 23.

prices had risen moderately from those prevailing in the middle of the decade. Prairie farmers were, however, still saddled with an impossible burden of debt, and farm buildings and equipment were in a desperate state of disrepair. Urban and public facilities were scarcely better preserved.

The early alignment of combatant groups in the new struggle, with Britain and France in alliance against Germany and Italy, suggested striking similarities between the circumstances of the first and second world wars. The imperative demand of the Allies for wheat after 1914 had given tremendous impetus to the expansion of the prairie wheat economy. There was much to suggest that the new conflict, deplorable though it was, would nevertheless solve the long-standing problems of the wheat market. The Canadian wheat carryover had fallen to 24.5 million bushels by July 31, 1938, and although it was 103 million bushels on July 31, 1939, the figure was still less than half the carryover at the ends of specific crop years in the middle 'thirties. Wheat prices rose with the British and French declarations of war against Germany and remained firm throughout the winter months of 1939-40. Prairie farmers increased their seeded wheat acreage from 25.8 million acres in 1939 to 27.7 in 1940. The obvious hope was that the disastrous economic conditions in the Prairie Provinces might soon be reversed.

The military developments of 1940 altered wheat-market prospects adversely and with drastic suddenness. The German occupation of Norway and Denmark, of the Low Countries and, finally, of France, all by mid-summer of 1940, closed western Europe to Canadian wheat or any other product. With a large crop of wheat in Canada in 1939,

with great pressure on shipping facilities and with the loss of substantial pre-war markets, the outlook for the disposal of Canadian wheat became worse than ever. By the beginning of the crop year of 1940 (August 1, 1940) the Canadian wheat carryover had trebled to 300 million bushels with a crop of 540 million bushels in harvest. On top of all these circumstances it was very early made clear that Britain's food demands were not to be exclusively or even primarily for wheat as in the first world war, but for concentrated protein and fat products involving bacon, beef and cheese, and a considerable range of dehydrated products including particularly milk and eggs. In response to these various circumstances a substantial segment of Canadian war-time agricultural policy after 1940 was directed toward the transformation of as much as possible of the prairie wheat economy into a coarse grains and livestock economy.

Measures designed to divert prairie acreage from wheat to coarse grains production began with the emergency imposition of marketing quotas in August, 1940. These were applied to oats and barley as well as wheat. In the spring of 1941 the Dominion Government instituted the wheat acreage reduction program which envisaged a reduction of one-third in prairie wheat acreage. A limit of 223 million bushels was set for prairie wheat marketings for the year, an amount estimated to represent the normal yield on two-thirds of the seeded acreage of 1940. Farmers were to be paid \$4.00 per acre for wheat acreage diverted to summer-fallow and \$2.00 per acre for land diverted to coarse grains or hay. Under the combined pressures and incentives of this policy, prairie farmers reduced wheat plantings by

22 per cent (6·2 million acres) in 1941 and by an additional 20 per cent of the original figure (5·5 million acres) by 1943. The first reaction was to leave the diverted acreage in summer-fallow, but by 1942 there was an increased interest in coarse grains and flaxseed with the establishment of minimum prices for oats and barley and a fixed price for flaxseed in March, 1942.

Climatic conditions favored wheat and other cereal production in the Prairie Provinces throughout the years of the second world war and indeed, throughout the 13 years from 1939 to 1951 inclusive. Marketing quotas and acreage reductions were not sufficient to keep the annual wheat crop down to marketable proportions. The Canadian carryover multiplied to a maximum of 595 million bushels at the end of the 1942-43 crop year, July 31, 1943. Elevator capacity in the Dominion, which amounted to 423 million bushels at the outbreak of war, was far over-taxed and was rendered only reasonably adequate by the construction of temporary and special annexes with a capacity of approximately 180 million bushels. The Canadian Wheat Board increased its initial price for wheat only twice during the war, from 70 to 90 cents per bushel (basis No. 1 Northern Fort William) effective August 1, 1942, and again to \$1.25 per bushel (same basis) effective September 28, 1943.

Restrictions on wheat marketings and only moderate increases in the price of wheat were paralleled by an almost unlimited demand for livestock and dairy products and by favorable prices for these products. In 1928, 72 per cent of the cash income from the sale of farm products in the Prairie Provinces had been derived from wheat. In the

late inter-war years approximately two-thirds of the cash income of prairie farmers came from the wheat market. In 1942 only 30 per cent of the cash income of prairie farmers came from wheat. In 1942 the Prairie Provinces provided 60 per cent of Canadian hog slaughterings as compared with 40 per cent before the war. For several years commencing in 1942 Alberta had a larger hog population than Ontario, and Saskatchewan was a not-too-distant third. Throughout the years of the second world war considerably less than half of the cash income of the farmers in the wheat economy came from wheat.

2. Cash Income and its Uses.—Cash income from the sale of livestock and livestock products from prairie farms multiplied during the years of the second world war. Increases in the income from these sources were more than sufficient to compensate for restrictions placed on the production and marketing of wheat. Total agricultural cash income in the prairie economy increased greatly over that of the pre-war years (see Tables XI and XIII above). Cash income from the sale of farm products in the Prairie Provinces had averaged just over two hundred million dollars per year for the first half of the 1930's and less than \$250 million per year for the entire decade. The annual figure became steadily higher following the outbreak of war. In 1943 it was just short of \$700 million and exceeded the figure for 1928 for the first time since that date. The wartime peak came in 1944 with a cash income for prairie agriculture in excess of \$1 billion. The average for the six war years, 1940 to 1945 inclusive, was \$634 million. The average for the five post-war years, 1946 to 1950 inclusive, was \$1,052 million.

The figures given above are gross figures. Production costs increased sharply for prairie farmers during the war years and the increases in gross incomes were by no means all clear additions to the net returns of producers. Nevertheless, net incomes increased markedly and the ready cash was available for a wide variety of essential purposes in addition to provision for living costs. Debt reduction was one of these.

Estimates cited above placed the agricultural debt in the Prairie Provinces at a peak figure of approximately \$800 million at the end of 1937. Debt cancellations reduced this total somewhat within the next year or so, but the increases in cash receipts which commenced with the marketing of the bumper wheat crop of 1939 and which continued with the more varied marketings of successive years made further reductions possible by way of repayment. The Dominion Mortgage and Investments Association released an analysis⁵⁸ on March 28, 1945, which embodied the estimate that prairie farmers had reduced their indebtedness between December 31, 1937, and December 31, 1944, by fifty per cent or by \$400 million. The Association summed up its analysis at that time by saying: "As a result [of debt reductions] the farm debt problem of the 'thirties has disappeared".⁵⁹ The Annual Report of the same Association, issued on May 1, 1952, summed up its comments on farm mortgage investments with the following paragraph:⁶⁰

"It will be noted that the amount owing by Alberta farmers shows a reduction of 76 per cent since 1937, whereas the amount owing by Saskatchewan farmers has dropped 84.8 per cent, and by Manitoba farmers, 83.3 per cent. This does not mean that Alberta farmers

have a poorer record than Manitoba and Saskatchewan farmers. Rather repayments by Alberta farmers since 1947 have been largely offset by money advanced on new farm mortgages in that province. The Manitoba figure would also show a greater reduction if repayments in recent years had not been offset partly by money advanced on new mortgages."

A substantial part of the cash income of prairie farmers during the war and post-war years had of necessity to be used for replacements and repairs to the machinery, equipment and buildings essential to farming operations. Machinery and repair parts and building materials were in short supply throughout the war years, but labor shortages and the deplorable condition of prairie farming equipment made it imperative that the utmost effort be made toward the provision of new implements and repairs. As indicated in Table VIII above), prairie farmers were able to make substantial net additions to their equipment by way of purchases of tractors, trucks and combines even by the end of the war. It should be emphasized also that the units purchased within these categories were substantially more effective than those which had been available a decade earlier. Trucks have, of course, been mounted on pneumatic tires from the early days, but not until the second world war did rubber tires come to be the standard type of mounting for tractors, combines and, indeed, for all other farm machines. Improvements in design, notably the development of the self-propelled combine and the increase in the economical operating speed of the farm tractor, have all contributed to the effectiveness of farm labor in the Prairie Provinces.

⁵⁸ *Report on Farm Mortgage Debts in the Three Prairie Provinces*, (Dominion Mortgage and Investments Association, March 28, 1945).

⁵⁹ *Ibid.*

⁶⁰ Dominion Mortgage and Investments Association, *Annual Report*, May 1, 1952, p. 11.

Other portions of the wartime cash income of prairie farmers went into the payment of arrears of taxes and into the purchase of rural and urban real estate. Funds devoted to the first of these uses, and to the payment of current tax levies as well, enabled provincial governments, municipal units and school districts to deal adequately with their essential functions for the first time in more than a decade. By the purchase of agricultural lands many farmers were able to enlarge their holdings to a more economical size. The purchase of urban property was for either one of two purposes: either to provide a town or city home for the retirement of an elderly farmer, or to provide a winter or year-round urban residence for the family of a still active farmer. Increasing proportions of prairie agricultural land are being operated by farmers who live continuously "in town", the town being a population grouping which may vary in size from a few dozen to many thousands of families and may be classified for local government purposes as a hamlet, a village, a town or a city.

3. *Population Movements during the Forties*.—Much of the impact of the second world war on the prairie economy was transitory but much, also, was of continuing significance. The continuing effects are most readily noticeable in circumstances where the pressures and incentives engendered by the war merely served to reinforce those already at work. Population movements provide the clearest example of this fact.

Census data (*see* Table II, above) indicate that the population of the Prairie Provinces increased by 125.7 thousand or by approximately five per cent from 1941 to 1951. This is less than half the rate of increase for the Dominion as a whole (exclusive of the

increase due to the entry of Newfoundland). Ontario and Quebec each increased their total by one-fifth and British Columbia by two-fifths from 1941 to 1951. The increase in the prairie provinces is placed more clearly in perspective when it is related to data concerning natural increase. Vital statistics reports issued by the Dominion Bureau of Statistics indicate that total natural increase (the excess of births over deaths) in the Prairie Provinces between 1941 and 1951 was approximately 396 thousand. Over the decade of the 'forties, therefore, with a population increase of 125.7 thousand, it is indicated that the Prairie Provinces had a net emigration of approximately 270 thousand or a number roughly equal to two-thirds of the total natural increase.

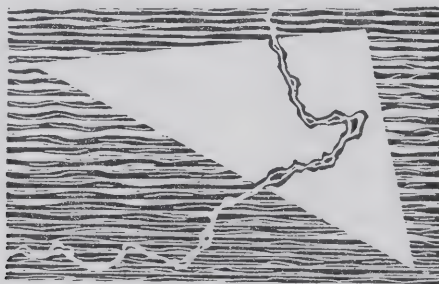
The circumstance in which the Prairie Provinces are unable to provide economic opportunities for their total natural increase, let alone for substantial net immigration, is not new, nor is it attributable to wartime influences. It has already been pointed out (*see* Tables XIV and XV, above) that the Prairie Provinces had a net emigration of approximately 248 thousand in the 'thirties. From 1936 to 1941 these provinces lost population equal to 96 per cent of their natural increase. The influence of war and post-war economic conditions was salutary for the Prairie Provinces in that the industrial expansion which came with the war and which multiplied thereafter provided occupational opportunities in the central provinces and British Columbia for the surplus labour of the wheat economy. Mechanization of prairie wheat farms has displaced farm labour in the West and made it available for employment elsewhere. War and post-war

industries have relieved the Prairie Provinces of unemployed and underemployed farm labour.

Saskatchewan was the only one of the Prairie Provinces which had an absolute decline in population between 1941 and 1951. In this province an absolute decline of 64 thousand, when taken in conjunction with a natural increase of 137 thousand, indicates a net emigration of just over 200 thousand for the decade. Neither Manitoba nor Alberta had a decline in population in the decade, but neither one retained all of its natural increase. Alberta came closest to doing so with an indicated net emigration of less than eight thousand for the decade. Most striking feature of the population situation in Alberta is the tremendous expansion of the cities of Calgary and Edmonton throughout the decade. The population of Calgary increased from 93 to 139 thousand and that of Edmonton from 98 to 173 thousand over the decade of the 'forties.

4. *Conclusion.*—Reasoning from the experiences of the years after the first world war an agricultural recession was confidently expected after the end of the second. This did not occur. Cash income of prairie

farmers averaged \$634 million per year throughout the war and \$1,052 million for the five post-war years, 1946 to 1950, inclusive. The Canadian Wheat Board has retained the monopoly position in the marketing of Canadian wheat which was assigned to it in September, 1943. The four crops from 1946 to 1949 were sold with the United Kingdom Wheat Agreement as the predominant instrument. Simultaneously the five crops from 1945 to 1949, inclusive, were placed in a compulsory domestic pool. Total payments for wheat delivered to this pool amounted to approximately \$1.83 per bushel, basis No. 1 Northern Fort William. An international wheat agreement governs the bulk of the crops from 1949 to 1952, inclusive, and negotiations are under way looking toward a new agreement to replace the current one upon its expiry. Livestock prices like wheat prices rose in the post-war years and remain high. Returns from wheat continue since the war, as they did during the war, to yield less than half the total of prairie agricultural income. This is a substantial change from the typical pre-war situation where wheat accounted for approximately two-thirds of the total.



Irrigation Development in Western Canada

IN HALF a century marked by notable achievements and painful reverses, the development of irrigation within the South Saskatchewan watershed had reached a total of 610,150 acres in 1952. Almost all of this acreage was in Alberta. The ultimate irrigated area allowed for, by extension of existing projects, was approximately 1,300,000 acres. Plans for the future, including the Red Deer River Project, bring the total to 1,721,400 acres. This is the full claim to date made upon the flow of the South Saskatchewan River for irrigation purposes, and it has been allocated by the Prairie Provinces Water Board and approved by the Governments of Canada, Alberta, Saskatchewan and Manitoba.

Irrigation was undertaken initially by private enterprise, but the prospects of profitable investment soon turned out to be illusory. As will be seen, the costs were transferred, in more or less degree, to the general taxpayer until today the provision of substantial public subsidy is taken for granted as a necessary concomitant of irrigation policy.

This section will review the beginnings of irrigation in Alberta, with the help and encouragement that was provided by the Federal Government through its Commission of Irrigation and, later, the Reclamation Service that was established in 1919. The stage

at which the Federal Government began to assume a share of the capital costs of irrigation works is relatively recent. An account is given of irrigation projects that were undertaken by corporate owners, and of the transformation of these into community organizations. Following that, the section will deal with the engineering, the colonization and the financial problems encountered in the development of irrigation in Western Canada, and the steps taken to solve them.

Beginnings of Irrigation on the Prairies

The development of irrigation in Western Canada has avoided the legal confusion that arose regarding water rights throughout most of North America. Legal difficulties arose principally because of a conflict between the traditional common law, derived from England, and the practice of the frontier. The common law was designed to secure to all landholders along the banks of a stream the right to enjoy the full and uninterrupted flow of that stream. The practice of the frontier, explicitly sanctioned by much local legislation allowed the appropriation, as private property, not only of land and mineral deposits, but of running water as well. This practice was in conflict with the accepted interpretation of common law, and endless confusion and litigation resulted.

Existing and planned projects, with acreages to be irrigated are:

Project	Acreage under Irrigation, 1952	Ultimate
Western Irrigation District.....	50,000	50,000
Eastern Irrigation District.....	200,000	281,000
Bow River Project (Canada Land)	50,000	240,000
Lethbridge Northern.....	75,000	96,135
United Irrigation District.....	21,000	34,000
Mountain View Irrigation District.....	3,600	3,600
Leavitt Irrigation District.....	2,500	4,400
Aetna Irrigation District.....	50	7,300
St. Mary-Milk River Project....	150,000	495,000
Red Deer River Project.....	(Planned only)	350,000
Macleod Irrigation District.....	500	5,000
*Small Projects.....	(Planned only)	64,000
Swift Current Irrigation Project..	7,500	21,000
Private Projects.....	50,000	70,000
	610,150	1,721,400

* Possible small projects in Alberta are:

	acres
Carmangay.....	12,000
Macleod Extension.....	20,000
Pincher Creek.....	16,000
Oldman projects.....	16,000
	64,000

Similar confusion never arose in Alberta, largely because the foresight and enthusiasm of a few civil servants in the Canadian Department of the Interior led to the adoption of an overriding statute, the Northwest Irrigation Act of 1894. The basic principles

of this Act have never been altered, and may be summarized as follows:

1. The ownership of all surface waters is vested in the Crown and these waters, or the right to their use, cannot become private property.

2. The use of water is regulated by licences from the Crown which are subject to cancellations for non-use or mis-use.

Subsequent amendments made little change in the principles of the Federal legislation, which proved remarkably successful in preventing the litigation and confusion elsewhere associated with irrigation development.¹

The earliest irrigation projects in Alberta were undertaken by private citizens who appropriated water and sometimes land, without title or licence. It was the activities of these early appropriators which had convinced Dominion officials of the necessity for comprehensive legislation governing the use of water. Private projects since 1894 have been regulated under government licence. Some seven hundred licences are now operating. The total area irrigated in this way amounts to only about 70,000 acres, and the total cost of irrigation works for the private projects is estimated at \$700,000 or approximately \$10.00 per acre.²

Construction of private irrigation projects has been facilitated by the operation of the Prairie Farm Rehabilitation Act, and Federal aid for such projects between 1935 and 1948 amounted to \$58,784.99 for a total of 365 such projects. In addition to cash subsidies, the P.F.R.A. provides complete engineering service free of charge.

¹ Col. J. S. Dennis, who as Chief Inspector of Surveys in the Department of the Interior was principally responsible for drafting the Northwest Irrigation Act, once stated that while "in the States to the South more money had been spent on litigation than on irrigation development" the Northwest Irrigation Act in Canada had been in operation for over 15 years and . . . they

had yet to have their first dispute in the courts in connection with that law. Report of the Proceedings of the Second Annual Convention of the Western Canada Irrigation Association, August 1908, Government Printing Bureau, Ottawa, 1909, p. 5.

² Report on Surface Water Supplies and Water Power of Alberta, Edmonton, 1948, p. 35.

The interest of the Dominion Government in irrigation developed out the policies pursued to settle the Canadian West.³ Land settlement required a method for locating parcels, and the rectangular system of the United States was adopted. The necessary survey activity occupied land surveyors in the West for many years. These surveyors employed by the Dominion Department of the Interior, were the first to realize the possibilities for irrigation in the semi-arid regions of southern Alberta, and their earliest reports contain frequent reference to the subject.

Much credit for awakening official interest in irrigation belongs to Wm. Pearce⁴ who was Superintendent of Mines in the West over the turn of the century. In his report of 1885 extensive reference is made to the possibilities of inexpensive irrigation of large tracts of land in various parts of grazing districts. He visualized the use of these lands for growing extra hay for feeding livestock. He suggested that this would reduce the risk to the ranchers and create more stability for the livestock industry.

Pearce's interest was later attracted to the possibilities of irrigating tracts of land which were being brought under cultivation by settlers. Evidently he was impressed by the increase in productivity achieved by the combination of cultivation and irrigation. After a trip into the Lethbridge district his

interest was heightened by the enthusiasm shown for irrigation in that area.

In 1889 he urged legislation, which was subsequently passed by the Northwest Assembly, to regulate the use of public waters for irrigation purposes. He also urged topographical surveys so that irrigation costs might be estimated and sites for reservoirs reserved. In 1893 the report of the Deputy Minister of the Department of the Interior suggested that the relatively small area which suffered from recurrent dry periods could profitably use irrigation, making the adjacent dry land more valuable. The Deputy and Pearce together submitted⁵ that about three million acres could be reclaimed from comparative aridity and rendered productive for purposes of mixed farming. The Dominion Government thereupon accepted a definite policy to encourage irrigation. One of the first steps taken was to send J. S. Dennis to the United States to study irrigation at first hand. As a result of the experience he gained, and upon his suggestion, the Northwest Irrigation Act was passed by Parliament in 1894. This Act regulated the use of waters flowing through the semi-arid region. Mr. Dennis became the first Commissioner of Irrigation under the Act and held that post for the next eight years.

The major task of the Commissioner of Irrigation was to survey the lands of Western Canada which were potentially irrigable.

³ Morton A. S. and Martin, Chester. *History of Prairie Settlement and Dominion Lands Policy*. Volume II, *Canadian Frontiers of Settlement*. Toronto 1938.

⁴ J. S. Dennis, Chief Inspector of the Surveys Branch, said in his report of 1894: The existing climatic conditions and the necessity for irrigation had been frequently referred to in the reports of land surveyors employed in surveying of this arid region into townships and sections, but it is probably due to the

lengthy reports upon the subject and to the persistent advocacy of the principle by Mr. Wm. Pearce, more than any other cause, that the public have at last recognized the necessity for irrigation and the benefits to be secured therefrom.

⁵ The submissions made by these gentlemen were aided by agitation from the Calgary Chamber of Commerce.

By 1897 Dennis had classified as arid all the area south of Clive from a point on the 4th Meridian north of Provost southwesterly to Three Hills and thence straight west to the mountains.

In the years that followed the beginning of the surveys, the Dominion Government did much to assist irrigation. For developmental purposes an Irrigation Branch Office was opened at Calgary. The duties of its staff were primarily to catalogue the water resources that might be used for irrigation and the areas to which the water might be applied. Extension work was carried on by the use of reports about irrigation, aimed to persuade the irrigation farmer to rely more on irrigation and less on the natural rainfall with its attendant uncertainty. These reports also explain the best methods to be adopted in irrigation farming.

The year 1898 marked the end of what may be called the experimental stage of irrigation development in Alberta. Dennis stated in his report for that year:

Private enterprise has sufficiently proved the benefits to be derived from irrigation to induce the investment of the sums required to complete the larger canals which must be undertaken as corporate works, this result being shown by the commencement of the construction by the Alberta Irrigation Company of the St. Mary Irrigation Canal . . .

Federal Participation in Irrigation

In pursuit of a general policy of developing the West and its resources, the Dominion encouraged irrigation but resolutely avoided financial participation. Irrigation over a large area in southern Alberta was physically possible, and if anything there was more land

than available water. The Dominion was prepared to facilitate development within the confines of its policy and to this end arranged possession of large blocs of land. Further, it passed the Northwest Irrigation Act designed to regulate the use of irrigation waters and to provide a system of selling land with a virtual rebate of two-thirds of the initial price to offset money expended on irrigation. The activities and personnel of the Dominion were effective and influential. The officers of the Irrigation Branch indicated their belief that the benefits of irrigation were:

- (a) the reduction of the risks to which farming and ranching were otherwise subjected;
- (b) continuous increased yields;
- (c) increased livestock producing capacity;
- (d) an increase in agricultural industries and services;
- (e) an increase in population and the assurance of its stability.

A recurrence of drought in 1914 was "the outstanding feature of the crop season".⁶ To the Irrigation Branch two such seasons in five years forcibly illustrated several things. First, it illustrated the wisdom of installing irrigation systems wherever the water supply would permit and the land was adaptable. Second, it showed the absolute necessity of improved farm methods for the conservation of soil moisture where dry land farming was practised. Third, it indicated the hazardous nature of grain farming as contrasted with mixed farming. After wet seasons in 1915 and 1916, the year 1917 was comparatively

⁶ Report on Irrigation for the year 1915. King's Printer. Ottawa 1916.

dry and in the next season the full effects of drought were again experienced. The interest of virtually all southern Alberta turned to irrigation.⁷ The Department of the Interior spent \$600,000 on irrigation surveys during that year alone.

The war introduced a period of stagnation into the development of irrigation. The difficulty of securing funds, the decline in immigration, a shortage of labour and the higher rate of wages forced the discontinuance of irrigation enterprises. The efforts of the Irrigation Branch at this time were directed to extension work emphasizing the importance of correct irrigation methods in producing maximum benefits. The difficulties in this matter were indicated by Superintendent Drake in his report for 1917.

Our officers are, primarily, engineers rather than agriculturists, and, while in the course of their duties they have acquired considerable knowledge of up-to-date agricultural methods, they cannot and do not profess to be agricultural experts.

Much of the stagnation in irrigation development is probably due to ignorance on the part of the settlers as to the proper methods to follow in order to produce the best results, and it would seem that the time is now ripe for a campaign of education along this line. Efforts are being made to secure competent agricultural experts who can first be taught the essential features of irrigation practice, and thereafter be assigned to the duty of advising and instructing the settlers. It is difficult, however, at this time to secure properly qualified men for this work, and there is very little prospect of much development along this line as long as the war continues.

As a result very strong demands arose for completion of the surveys of all large projects which have been

contemplated and in addition a very large number of applications were received during the year from persons who wanted to construct small private schemes. It was not found possible to complete either all the large survey work required, or the necessary inspection of the small private schemes. It is consequently expected that a very heavy program of work will have to be undertaken in both these departments during 1920.

Annual Report of the Reclamation Service, 1919-20. King's Printer. Ottawa 1920.

In 1919 the Dominion Government recognized its responsibilities for reclamation work in western Canada and established the Reclamation Service. There was an insistent demand for the Government to either construct the necessary works or materially assist in financing of construction. Early in 1919 the Minister of the Interior (Mr. Meighen) made a definitive statement of the position of the Dominion Government. He said:

. . . After prolonged correspondence and after many conferences where we failed to agree, we finally came to an understanding, and the Provincial Government acquiesced in our position that we should not be called upon to undertake further responsibility after we had undertaken and discharged the work of surveying the whole field and of engaging the engineering forces necessary for that purpose. We propose, now that we have come to an understanding, to carry it out on our part to the full and to interpret the understanding generously. Already I have instructed that to be done.⁸

The clarification of responsibility which was implied in these words did not solve the problem of finance. W. A. Buchanan, Member of Parliament for Lethbridge, was most concerned with this side of the matter and

⁷ Irrigation meetings were held on February 19, 20 and 21, 1919 at Turin, Coalhurst and Monarch, with respective attendances of one hundred and thirty, eighty and seventy farmers. These meetings were all strongly in favour of irrigation, with the partial exception of the meetings at Monarch where the members of a colony of Dutchmen surrounding this town were opposed to irrigation development.

As was indicated in last year's report, due to the succession of two dry years, 1917 and 1918, a very strong

movement developed in the south country during the winter of 1918-19 in favour of irrigation development. The year 1919 was almost as dry as 1918 with the result that people in Southern Alberta—both farmers and business men—have at last become generally convinced of the great desirability, if not necessity, of irrigating every possible acre in southern districts.

⁸ Official Report of the Debates of the House of Commons of the Dominion of Canada, 1919. Volume 5. Page 4603.

made every effort to get Dominion aid. The Director of Reclamation reported on the subject in these terms:

The principal deterrent to further irrigation development is the difficulty of financing. The money for the construction of new works must be raised by bonds secured upon the land and irrigation bonds are not readily saleable at anything like par value.

The only practicable solution of the problem seemingly is the purchase of the bonds either by Provincial or Dominion Government, but this is a question of policy that must be decided by the Governments, and its further discussion in this report would be inappropriate. It is to be hoped however, that some solution of the problem will be found quickly.⁹

A "solution" to the finance problem was given by the several Acts dealing with irrigation passed by the Alberta Legislature in the early nineteen twenties. These Acts will be discussed at a later stage of this study but it must be noted that from 1920 to 1935 they provided the basis for irrigation development in Alberta.

St. Mary-Milk River Development

In the year 1935 the irrigated area in Alberta was in excess of 400,000 acres but the problem of drought costs still faced the Dominion. In the years that followed the good yields of 1927 and 1928 farm distress reached alarming proportions. In 1934 the Dominion Government passed the Prairie Farm Rehabilitation Act which committed resources to an attack on the drought problem on a broad scale. As part of the program stemming from this Act there was a re-examination of irrigation possibilities in Alberta. The St. Mary and Milk Rivers Water Development Committee Report represents the considered opinion of both

Provincial and Dominion officials on the economic basis of these possibilities. The matter can not be stated more succinctly than by direct reference to the findings of the Committee.

The report summarized the benefits which the proposed development would confer:

National Benefits

1. The completion of the development would provide an insurance against the loss of a valuable national resource.
2. The construction of the project following the war would provide employment during the readjustment period.
3. The lands made irrigable would provide opportunity for establishing returned soldiers and others including farm families located on submarginal lands with the drought area, thereby effecting a substantial saving in relief expenditures.
4. Increased production and volume of trade from irrigation development would result in business expansion to transportation, manufacturing, and other national interests and the general benefits arising therefrom would be of advantage to Canada.

Provincial Benefits to Alberta Municipalities and Local Communities

1. Stabilization of agriculture on lands irrigated and adjoining grazing lands comprising a large section of southern Alberta.
2. Increased production would result in increased assessment values for taxation purposes.
3. Increased production and buying power would result in increased business opportunities to provide goods and services to a prosperous farm population.

Benefits to Ultimate Landowners and Water Users

1. Insurance against crop failure in years of drought.
2. Opportunity for diversifying crops to meet changing market requirements, and to reduce wheat acreage.
3. Increase in land values resulting from increased production.
4. Opportunity for home-building, a higher standard of living, and improved social services.

⁹ The Report of the Reclamation Service, 1919. King's Printer, Ottawa 1920.

The Committee concluded that:

While the annual cost of maintenance and operation of the proposed development should be regarded as a proper charge against the lands irrigated, a substantial part of the capital cost, depending on condition, could not be fairly charged against them.

The acceptance of this Report and the construction of the St. Mary-Milk River project under an agreement between the Federal and Provincial Governments marked a major change in the policy of the Federal Government in regard to irrigation development. The terms of this agreement provided, in effect, that each government contribute about one-half of the cost of the major capital works. The Federal Government had previously avoided financial participation in irrigation construction but had now recognized the relationship of irrigation development to national economic well-being. Irrigation thus came to be included with other aspects of agricultural resource conservation and development, and action along these lines has been implemented by the Prairie Farm Rehabilitation Administration.

The P.F.R.A. has had a considerable part in the later development of water resources in Western Canada. This administration was established in 1935 primarily to provide emergency action against the soil erosion and local water shortages that accompanied the drought of the period. Its early activities included regrassing in areas of light soils and the promotion of farming practices to control erosion and conserve moisture.

Water development under the P.F.R.A. began with assistance to individual farmers to construct dug-outs and small dams to conserve local run-off for domestic water, stock-watering and irrigation for gardens and small fields. While individually small,

there were 46,534 farm projects at March 31, 1952, and the aggregate of these developments is considerable.

The numerous small streams and watercourses in the prairie area provide opportunities for water storage in larger reservoirs. At March 31, 1952, P.F.R.A. had constructed 244 of these, which are designated as community projects because of the diffusion of use over a wider area. This applies not only to the number of individuals affected but also to the regional stability which results, as in the case of local ranchers who are assured of feed supplies from the irrigated land.

As development on smaller watercourses proceeded, the attention of the P.F.R.A. was directed to the larger rivers in the area, notably the St. Mary and the Milk Rivers in Southern Alberta, the Red Deer and Bow in Central Alberta and the lower South Saskatchewan River in the Province of Saskatchewan. Irrigation development on these rivers involves major works, of which the St. Mary-Milk River Development is now approaching completion at an over-all cost of about \$40 millions. Development of the Bow River is now being furthered on the former Canada Land and Irrigation Project, purchased by Canada and under the administration of the P.F.R.A. Irrigation development on the Red Deer River, in the vicinity of Hanna, Alberta, is now under study as is the proposed South Saskatchewan River Development above Saskatoon.

Throughout its period of operations the P.F.R.A. has assisted in the construction of individual farm projects which conserve enough water to irrigate over 110,000 acres. Sufficient water storage has been created on community irrigation schemes to irrigate

328,758 acres if the water were all committed to that use. The major part of the St. Mary-Milk River Development is designed to irrigate 519,000 acres. The Bow River Project, which the P.F.R.A. now has in hand, is delivering water to 57,000 acres with plans for extensions of an additional 180,000 acres.

The St. Mary and Milk Rivers are both international streams. The allocation of such waters between Canada and the United States is influenced by the principle of prior appropriation and beneficial use, and the United States has held the point of view that they should not be deprived of the use of international water which would otherwise be wasted.

Accordingly, it was expedient for Canada to prepare to put to beneficial use the waters of these two rivers allocated to this country by the Treaty of 1909, and subsequent decisions of the International Joint Commission.

Formerly known as the Lethbridge South-eastern Project, this development was surveyed and mapped between 1913 and 1922. Construction of the works was undertaken by the Prairie Farm Rehabilitation Administration, and mostly completed in 1951. The key structure is a large dam and reservoir on the St. Mary River, together with auxiliary reservoirs and appurtenant works. The main distribution canal leads from the St. Mary reservoir towards the irrigable land to the northeast.

A total of 796,000 acre-feet per year are thus to be made available to the system for the irrigation of about 120,000 acres for which water rights have already been granted, and for an additional 345,000 acres of new land. The total area to be served by the system is thus about 465,000 acres.

The St. Mary-Milk River development has been brought to fruition at this time by joint action of the Governments of Canada and the Province of Alberta. The contribution of each party is defined in a formal agreement. The Federal Government has undertaken the construction and maintenance of the main dams and reservoirs and their appurtenant works. The Government of Alberta has assumed responsibility for the construction of the secondary distribution system which delivers the water to individual farms, and for a satisfactory colonization program. In financial terms it is expected that the contributions of both governments will be approximately equal. These arrangements represent the basis on which the Federal Government abandoned the position it had held closely in previous years, and undertook to participate in the financing and construction of irrigation works in Western Canada.

Corporate Irrigation Development

1. *The Alberta Railway and Irrigation Company.*—Large land grants were made to the railways in western Canada to provide finances for railroad construction. The mere sale of these lands was not sufficient from the railway standpoint; it was also necessary to make them productive of traffic. Railway lands thus had a dual role. Initially they were to provide capital, later they were to provide operating revenue. Railway irrigation expenditure in Alberta must be analyzed in this context.

The pioneer company in Alberta irrigation, The Canadian Northwest Irrigation Company, grew out of the Alberta Irrigation Company, a land-holding subsidiary of the

Alberta Railway and Coal Company. The Alberta Railway and Coal Company had been granted two million acres of land by the Federal Government as a subsidy for the construction of a railway from Dunmore to Lethbridge and from Lethbridge to Great Falls, Montana. In 1892 the Canadian Pacific Railway took a lease-purchase-option on the Dunmore to Lethbridge section of the railway with the result that the land held by the Alberta Railway and Coal Company became highly significant to that company. At this time John W. Taylor and Charles O. Card, who were interested in establishing Mormon settlements in southwestern Alberta, obtained an option on certain of the lands owned by the Alberta Railway and Coal Company with the intention of promoting irrigation development. Because of the alternate section pattern of the land holdings of the railway, exploitation for irrigation was not feasible and the option lapsed. The two had succeeded in stimulating the irrigation interest of the Galt brothers, Sir Alexander and Elliot T., holders of a large equity in the Alberta Railway and Coal Company. These gentlemen forthwith incorporated the Alberta Irrigation Company.

The Alberta Railway and Coal Company arranged an exchange of land with the Honourable Clifford Sifton, Minister of the Interior, and accepted a block of potentially irrigable acreage in return for part of the original grant. This company then made the block of land available to the Alberta

Irrigation Company at \$2 per acre. This company in turn sold parts of it to settlers at \$10 per acre. After some delay a canal was constructed from the St. Mary River to these lands and irrigation commenced in 1901. This marked the first corporate irrigation in Alberta.¹⁰

In 1898 the Alberta Irrigation Company became the Northwest Irrigation Company and in 1904 it was amalgamated with the Alberta Railway and Coal Company to form the Alberta Railway and Irrigation Company. The assets of this Company were acquired in 1912 by Canadian Pacific who operated the irrigation side of the enterprise until 1946 when the ownership and operation was transferred to the Government of Alberta.

The first organizers of the company, Taylor and Card, apparently based their calculations on the belief that the increased productivity of the land would increase the value to an extent sufficient to enable them to repay the capital costs of the development. However, they were not as much concerned with economics as with sociology; specifically they were interested in establishing Mormon settlements in the area. When they were forced to abandon the original project because the land was not in a block they entered into a deal with the Galts. The Galts were responsible for the promotion of the project as actually constructed.

The economic interests of the Alberta Railway and Coal Company and the Galt

¹⁰ The report to the Minister of the Interior in 1901 spoke optimistically of the future development likely to arise due to the water supplied by the newly completed canal.

The changes which will be brought about within a few years promise to rival the most rapid develop-

ment in any portion of the west, and there now seems to be no doubt that a large area which up to this time has been entirely devoted to the grazing of cattle and sheep will in a very short time be covered with farms producing abundant crops by the aid of irrigation.

brothers were very closely connected. They were willing to spend money on irrigation for three reasons:

- (a) Land potentially irrigable commanded a premium when sold for settlement. In addition, when the land was settled and the water available the investment in irrigation facilities offered very choice returns to its owners.
- (b) The increase in land productivity would enhance the general prosperity of the area and as there was a number of privately owned enterprises held by officials of the Alberta Railway and Coal Company, these men would enjoy substantial gains.
- (c) Direct and ancillary services of the operating company would gain from the introduction of the closer settlement encouraged by irrigation.

2. *Canadian Pacific Railway:* Canadian Pacific was interested in the irrigation scheme from its inception. In 1898 they offered to subsidize construction to the extent of \$100,000 because of the potential feeder line traffic that would originate in the irrigated area. It is also important to remember that at this time Canadian Pacific was very anxious to build new lines and reorganize old ones to get into the newly developed area of the Kootenay Valley of British Columbia.¹¹ The relationship between the railroad and irrigation was to some extent conditioned by this development.

When Canadian Pacific purchased the assets of the Alberta Railway and Irrigation Company in 1912 the land and irrigation works of that Company were incorporated into the general colonization program of the railway. The economic interest of Canadian Pacific was not primarily the irrigation works but the railway and coal holdings of

the Alberta Railway and Irrigation Company. They proceeded with irrigation as a secondary matter.

The acceptance in 1903 by Canadian Pacific of a block of land between Calgary and Medicine Hat that had been previously termed "not of fair average quality for settlement", as settlement of its outstanding grants, was premised upon several considerations. The Company was faced with the necessity of choosing the "irrigation block" along its lines, or more humid lands farther to the north where a settler would be too far from the railway to contribute traffic. The choice made by Canadian Pacific was based primarily upon the claims of the Federal Government engineers as to the economic feasibility of irrigating the area. It was suggested that the use of Bow River waters could bring irrigation at a capital cost of \$3.50 per acre. With this figure as a planning base the company anticipated a traffic stream "that would far excel that of any similar area in Western Canada".

From the record it appears that while a general increase in the value of land was expected by Canadian Pacific they made the irrigation investment not in anticipation of land profits and profits on irrigation construction, but almost wholly in terms of increased railway traffic. In these early stages there was certainly no thought of losing money just to create irrigation, but on the other hand the use of irrigated land sales as a source of capital funds comparable to the dry land sales was not seriously considered.

¹¹ Negotiations are pending with the Alberta Railway and Coal Company for the lease and subsequent purchase of that Company's line extending from Dunmore to the coal mines at Lethbridge, 109 miles. This line will be

necessary to your Company in the event of the construction of a line through the Crow's Nest Pass, and in any case it will be quite self-supporting.—Canadian Pacific Railway; Annual Report, 1892.

The general view of Canadian Pacific therefore appears to have been that irrigation would not result in a new cost to the Company, but would do away with uncertainty in a hazardous crop area and would greatly increase the productivity of the land. Intensified farming with increased farm and non-farm populations would create an area exclusively within the orbit of their own transport system and enure to the general good of that system. They anticipated a sufficient return from irrigation to pay capital costs and this would leave the net return from the increased traffic as a clear profit which would accrue annually in ever-increasing amounts. They assumed, in common with everyone else, that the farmers would be able to pay for the higher priced land as a result of the increased productivity.

By 1929 it was apparent that the original economic basis for expenditure had been incorrect. While there had been traffic benefits to the railway there were large capital, operating and maintenance deficits. The problem at hand resolved itself into the selection of a suitable way to get out from under the load.

In 1935 the farmers of the Brooks area "approached" the Company with the suggestion that they (the farmers) form an Irrigation District and take over the operation of the project. There was little reluctance by Canadian Pacific to this suggestion. From 1930 to 1934 the annual cost to the Company of maintaining the project had been in excess of \$450,000 per year and the officials of the Company felt that until the success or failure of the scheme rested directly upon the farmers there was little hope of improving the situation. The farmers

in turn were burdened by capital costs which they saw no hope of repaying.

As a result of an agreement between Canadian Pacific and the farmers, the Eastern Irrigation District came into existence. This District took over all the land and irrigation structures of the Company and in addition received \$300,000 as a cash grant.

In 1944 Canadian Pacific was similarly induced to turn the Strathmore section over to the farmers who had organized an Irrigation District. The capital costs on the land classified as irrigable were a burden which the productivity of the land would not bear. In addition, irrigation was not used efficiently because the natural precipitation was often sufficient. This project was given to the farmers to eliminate the cost of maintaining and operating the system, but the Company transferred only its irrigation works, canal rights-of-way and so forth. They retained their land contracts and unsold lands. A cash bonus of \$400,000 was paid by the Company. In similar fashion the Alberta Railway and Irrigation Company works were given to the Government of Alberta in 1946. The Company retained its contracts and unsold lands and paid a cash bonus of \$100,000.

The experience of Canadian Pacific in the matter of irrigation development may be summarily stated. They undertook development because they anticipated a small return on their land and structures and they wished to develop rail traffic. They ended their irrigation experience by giving the major part of their investment to the farmers along with a cash grant. They were content to minimize their losses on irrigation and escape with the traffic increases the losing investments had generated.

3. *Canada Land and Irrigation Company:* The history of irrigation development in Alberta reveals only one enterprise which entered the field solely concerned with the commercial possibilities that were afforded, the Canada Land and Irrigation Company. There was no duality of motive in this instance; the economic basis was the anticipated investment return and nothing else.

In June 1906 the Robins Irrigation Company made an Agreement with the Dominion Government to purchase 380,000 acres of potentially irrigable land in the Medicine Hat area at a rate of \$3 per acre.¹² The acreage conveyed by the Agreement covered a project "developed" by Government engineers and it was undoubtedly the favourable views advanced by these men that prompted the activity of the Company. The Robins Company made a few preliminary surveys for canal location and with the consent of the Government transferred their interest to the Southern Alberta Land Company, an English syndicate with head offices in London. Further surveys by this Company revealed that a considerable portion of the tract they had purchased could not be irrigated so an exchange of land was arranged.

Engineering work on the project commenced in earnest in 1909. To the end of 1913 the Company had spent more than \$8,000,000 without irrigating an acre and could foresee the expenditure of an additional \$3,000,000 to complete the system. The Robins Company had anticipated a total investment of about \$1,750,000.

The engineering and financial difficulties, which made the Company's problem so com-

plex, created considerable scepticism as to its ability to carry the project to a successful conclusion. Reorganization in 1917, which amalgamated it with the Canadian Wheatland Company to produce the Canada Land and Irrigation Company, eased the financial strain. The new company completed the main canals in 1918. In 1920 the first land was irrigated.

From 1919 to 1950, when the assets of the Canada Land and Irrigation Company were purchased by the Federal Government, the project operated on a subsistence basis.

Present Status of Irrigation Projects

Most irrigation activity in Alberta at present is carried on by community organizations formed for the express purpose of operating irrigation systems and ancillary institutions, possessing quasi-municipal status, and known as Irrigation Districts.

Irrigation Districts were first authorized under an Ordinance of the Northwest Territories of 1894, which was repeatedly amended by the territorial legislature and was finally repealed by the Alberta Legislature in 1915 when the present Irrigation Districts Act was substituted for the earlier measure.

Only one Irrigation District was set up under the territorial ordinance, the Springbank Irrigation District, incorporated in 1898 to serve 23,493 acres near Calgary. This district borrowed \$40,000 and carried out considerable construction work, but apparently never delivered any water. The works fell into disrepair, but the debt remained for years a charge against the land of the

¹² An outline history of the Canada Land and Irrigation Company may be found in the 1913-1914 Report of

the Superintendent of Irrigation for the Department of the Interior. King's Printer. Ottawa. 1914.

District until in 1914 the Provincial Legislature passed an Act for the Relief of the Springbank Irrigation District. Under this measure the provincial government paid off the remaining principal debt of \$25,000 on the understanding that the District itself would meet the outstanding interest and costs of \$15,000.

The Irrigation Districts Act of 1915 was based on a California Statute and was framed especially to meet the requirements of the Taber Irrigation District, which was formed in the same year. This district, like the Magrath Irrigation District and the Raymond Irrigation District, formed respectively in 1925 and 1926, receives water from the works originally constructed by the Alberta Railway and Irrigation Company.

The Lethbridge Northern Irrigation District was formed in 1920 and was the only large project to operate as an Irrigation District from its inception. Its irrigable area of 96,135 acres is exceeded only by that of the Eastern Irrigation District and by the Canada Land and Irrigation Company development.

The huge C.P.R. irrigation block has now been transferred to Irrigation Districts, the Eastern Irrigation District formed in 1935, being the largest project in the province, with 281,000 irrigable acres. The Western Irrigation District, which took over the operation of the western section of the C.P.R. irrigation block in 1946 has an irrigable area of 50,000 acres.

The Canada Land and Irrigation Company has now been transferred to public ownership and new developments in connection with the St. Mary-Milk River Project

are being integrated with the provincially operated Alberta Railway and Irrigation Project.

Four other small Irrigation Districts were set up during the inter-war period—the United Irrigation District in 1921, and New West Irrigation District in 1923, the Mountain View Irrigation District in 1925, and the Leavitt Irrigation District authorized in 1936. The Aetna Irrigation District formed in 1945 is the only other post-war development undertaken to date.

Irrigation Districts have thus taken over all the important enterprises in the province. The Irrigation District would appear to be the most durable form yet devised for the administration of irrigation projects.

General Progress of Irrigation Districts

The Irrigation Districts have had a singularly varied history, both with regard to the obligations initially assumed and as to the degree of prosperity attained. Most successful of the group has been the Taber Irrigation District, whose works cost \$272,000 for the irrigation of 17,000 acres. These works were constructed for the District by the C.P.R. and were paid for by the issue of six per cent 30-year debentures, the entire issue being accepted by the C.P.R. Interest on the bonds was adjusted to five per cent during the depression, and principal payments had to be deferred for four years during that period, but these concessions were the only ones required. As of Dec. 31, 1951, the District had a bonded indebtedness of \$27,200. The original district has been increased by approximately 25 per cent, from 17,000 to 21,500 irrigable acres, and the works necessary for this expansion have been

paid for out of revenue. This District is almost unique in that it has been a straightforward commercial success. It enjoyed the advantage of a very low construction cost, averaging only \$13.66 per acre for the full area, but this advantage was partially offset by the disadvantage of having to buy water, at a rate of 50 cents per irrigable acre per year. There was no offset, however, to the principal advantage enjoyed by the Taber District—the fact that it was already settled with a strong community of experienced and enthusiastic irrigators. It was spared to a considerable extent the costly process of development and the equally costly and painful process of weeding out unsuitable settlers, which other districts had to endure. Partly because of this advantage the District was able to attract at an early date industries providing a market for those specialized crops on which the success of an irrigation project ultimately depends.

None of these advantages was enjoyed by the Lethbridge Northern Irrigation District. Its cost of construction was high, \$57.00 per acre, its bonds sold at a heavy discount, and it suffered more than its fair share of disaster from unforeseen flood damage. The settlers already in the district were unused to irrigation and had little appreciation of the methods required or the drudgery involved in irrigation farming. While a sugar beet factory was eventually secured, the market for specialized crops is still far from adequate. Financially the project has been discouraging.

The Eastern Irrigation District, on the other hand, began its career in peculiarly favourable circumstances. It owed no debt

whatever for its irrigation works, which had been constructed by the C.P.R. at a cost of \$13,000,000, approximately \$47 per irrigable acre. The railway company had shouldered the heavy operating loss of approximately \$315,000 per year during the twenty-year period of development and settlement, and had colonized the district with reasonably suitable settlers, experienced by 1935 in the techniques of irrigation. At its formation the district received a comfortable cash subsidy of \$300,000 from the C.P.R. and acquired from that company not only clear title to the irrigation works but also to the unsold lands in its district, to the company's buildings, machinery and equipment, and to its equity in the lands which were already under agreement for sale. Starting with these considerable advantages the district has operated quite successfully since 1935, even though no adequate markets for specialized crops have yet been developed.

Problems of Irrigation Development

The Engineering Problem: The engineering problem is many sided and highly technical, usually beyond the comprehension of the layman, except when the failure to solve it results in spectacular disaster. It can be subdivided into the following phases:

1. The problem of water supply is always present, for in any area requiring irrigation the amount of land needing water to increase its productivity far exceeds the available supply of water. Strict government controls imposed from the very beginning of irrigation development on the Canadian

prairies have virtually eliminated this problem here. With one early exception, the Springbank Irrigation District, all projects undertaken have had ample water supplies assured. This assurance results from:

- (a) Accurate hydrographic records of stream flows at all seasons of the year, and over a sufficient succession of years to determine the quantity of water actually available.
- (b) Adoption of a satisfactory unit of measure—the acre-foot—has proved in practice far superior to the “miners inch” unhappily used as a standard in much of the United States and in British Columbia.
- (c) A clear and explicit legal definition of the duty of water.

Complaints of water shortage are chronic in all irrigation districts, but have no real validity in Alberta, at least for the present. The early Regulations, adopted under the Northwest Irrigation Act and copied into the Provincial Water Resources Act, set the irrigation season as the period from May 1st to September 30th inclusive, adopted the cubic foot per second as the unit for measuring the flow of water, and fixed the duty of water—the amount of land irrigable by this unit of flow delivered through the 153 days of the irrigating season—at 150 acres. Such a flow would provide almost exactly (excluding losses through evaporation and seepage) a

total delivery of 24 inches depth of water for an area of 150 acres, providing the water users applied a continuous flow for 24 hours a day throughout the entire irrigating season.

Most of the early canals were designed in accordance with these regulations to provide a flow of one cubic foot per second for each 150 irrigable acres. This design naturally restricted the rate of flow required to sustain uniform crop growth in a farm unit as all the area needs water in a reasonably short period to prevent crops deteriorating. The generally accepted minimum use is at the rate of 2.5 second feet or the equivalent of 5 acre-feet per day. This volume, applied to land in depths of 4" to 6", will irrigate 10 to 15 acres per day thereby enabling 160 acres of land to be irrigated in 12 to 16 days. This rate of required flow is about twice that provided for in the original regulations, necessitating the enlargement of the works built in the early railway projects.

The inadequacy of the earlier structures is at present important only in the case of the Brooks aqueduct whose low capacity is a real impediment to further development in that area.

In general, water is still rather wastefully applied in most regions, and if much expansion of the irrigated acreage takes place, farmers may find it difficult to adapt themselves to the legal duty of water.¹³

2. The Adequacy of Engineering Structures: No engineer can plan the construction

¹³ In a report on the available water supply of the Bow River, prepared in 1945, Mr. F. R. Burfield, Chief Engineer for the Department of Water Resources, pointed out that in 1944 the Eastern Irrigation District had diverted 650,000 acre-feet to serve an area of only 160,000 acres. The difference between the presently obtainable

amount of more than four feet per acre, and the legal allowance of only 18 inches per acre which may have to be enforced in the near future, is rather alarming. (See Report on Surface Water Supplies & Water Power of Alberta, 1948, p. 57.)

of works proof against all possible contingencies, and every structure involves acceptance of a calculated risk of failure. The "margin of safety" allowed depends partly on the conscience or optimism of the engineer, partly on the funds available for expenditure. Structures in Alberta have been generally adequate, but certain costly failures or miscalculations have occurred. Both the Canada Land and Irrigation Co. and the Lethbridge Northern Irrigation District suffered disaster when unexpected floods destroyed their intake structures and postponed for a year or more the initial delivery of water. Operation of the Taber Irrigation District was hampered by dust storms which filled ditches and made it impossible to provide water for irrigation until the growing season was over during the first year of that district's operation. The Canada Land and Irrigation Co. suffered further delay and loss during the 1919 irrigating season through the inadequacy of the canal designed to draw water from Lake Macgregor, and the usefulness of this system is still restricted by the cave-ins which cut down the capacity of its main canal during the first year of operation.

Although Alberta has suffered no major disaster from the failure of irrigation works, much of the construction has been admittedly flimsy, and durability has been regularly sacrificed to cheapness. Sir William

Willcocks, who visited the major Canadian projects in 1912, remarked that "all the regulating works on the rivers are much bolder here than in the East, where the welfare of millions of people is concerned we cannot afford to run any risks. Time alone can tell whether the boldness of the engineers here is justified or not".¹⁴

Standards of maintenance have been even more flexible than standards of construction. Where money is scarce, shaky structures are likely to be continued in service long after good engineering practice would require their replacement.

The Colonization Problem.—Much of the history of Alberta irrigation development revolves around the problem of colonization, the securing of suitable settlers to farm the lands brought under irrigation.

In a few cases, settlement preceded irrigation. This was the case in two of the earliest projects in Alberta, whose history has been strikingly dissimilar. The Springbank Irrigation District was set up by farmers already established in the Calgary Area, who had no previous experience in irrigation and who accepted the idea chiefly to prevent some other organization securing water rights which might later become valuable. Before the system was completed a succession of wet years had destroyed all inducement to use the new facilities, and the loosely drafted Northwest Irrigation Ordinance imposed no compulsion to pay for them. This project was an unqualified failure, even though the

¹⁴ Report of the Proceedings of the Sixth Annual Convention of the Western Canada Irrigation Association, p. 177. In this connection, Mr. P. M. Sauder, with all deference to the reputation of Sir William rejects the implied criticism. The works, while as cheap as good practice warranted, were not flimsy in the sense that they represented in any way a danger either to life or to property. The life of wooden structures is admittedly

short; where revenue expected is large, particularly in the early stages of operation, it is undoubtedly more economical to build permanent, concrete structures. Where these conditions are not present, a cheap wooden structure will serve equally well until revenues expand sufficiently to warrant their replacement by more expensive and more durable constructions.

problem of colonization did not arise. A sufficient number of settlers were already in the district at its inception, but they had neither the present need nor the past experience to use the system which had been created.

The Mormon immigrants who began to settle in Alberta in 1887 had an entirely different background. They were refugees expelled from the United States by the operation of the Edwards Act, and they came from an area which had been for the previous forty years almost completely dependent on the production of irrigated lands. It was their enthusiasm for irrigation that helped to convince both the officials of the Federal Department of the Interior and the railway officials of the possibilities of irrigation development; it was their labour that helped to construct the original works of the A.R. & I., and it was their skill which utilized the water as soon as that company began deliveries in 1901.

The problem of colonization assumed a particularly urgent form with the development of the Lethbridge Northern Irrigation District in the 1920's. This was an area which had grown up under dry farming conditions and had enjoyed a period of considerable prosperity. Roads, railways, telephone systems, school districts and villages had all come into existence to serve the agricultural community, and all such enterprises were threatened when a succession of dry years undermined the farming economy. The irri-

gation project was intended to restore and to enhance the prosperity on which all sections of the community depended.

From the inception of the project it was realized that a drastic change would have to be effected in farming methods. A Royal Commission, the Survey Board for Southern Alberta, in a Report submitted to the provincial legislature early in 1922, emphasized that "as irrigation water is made available a much greater number of farmers on smaller farms is essential . . . a farmer with a growing family will succeed far better on irrigated land by concentrating his efforts on a holding that, in comparison with what may be worked under dry farming conditions, would be considered small . . . a quarter section (160 acres) 'under the ditch' is the maximum area that a farmer and his family may farm profitably". To reduce farms in the district to this desirable size, the Survey Board recommended that the Trustees should secure firm listings for sale of the "surplus" lands, and should then carry out a vigorous colonization campaign to secure the resale of these lands to new settlers. Since the average size of farm holding in the district was about 450 acres, such a program envisaged a great reduction in the size of the farm unit.¹⁵ During the grain boom of 1915-19 much of the land had changed hands at high prices—from \$75.00 up to as much as \$100.00 an acre. The district had undertaken to construct irrigation works costing \$57.00 per acre and presumably enhancing

¹⁵ Large land holdings in 1924 were approximately as follows:

Dominion Lands.....	4,899 acres
C.P.R. Lands.....	7,780 acres
British-Canadian Trust Co. Lands	5,883 acres
Individual farms:	
1 farmer had.....	2,560 acres

2 farmers had, each.....	1,760 acres
1 farmer had.....	1,600 acres
5 farmers had, each.....	1,120 acres
3 farmers had, each.....	960 acres
5 farmers had, each.....	800 acres
17 farmers had, each.....	640 acres
26 farmers had, each.....	480 acres

the value of the dry land by an equal amount. It was difficult in the circumstances to persuade farmers to offer their surplus land at prices which offered any inducement to settlement, and the district began operations with farms still far from the optimum size. Rates were first levied in 1924, at the rate of \$5.25 per irrigable acre, and very few of the water-users were either able or willing to pay the assessment. Total collections amounted to only \$13,269.52 against a total levy of more than \$500,000.00.

The ratepayers' strike led to a drastic remedy. Acting on the advice of Dr. J. A. Widtsoe, contracts were revised to spread the water-users' payments over a fifty-year period with very low payments required in the earlier years of the contract. This concession was given only to owner-occupiers and only for a Home Place of 320 acres. All other land in the district, whether held by non-resident owners, or surplus land held by resident owners, was required to pay the full annual charge of \$5.25 per acre. A special Rate Enforcement Act was passed by the Legislature in 1926 to enable the district to seize lands for arrears of rates and these lands were then transferred to a colonization manager for sale to settlers.

In 1925, the first year of full operation of the district, some 70,000 acres were in use for all purposes—crop, pasture and summer-fallow. Only 48,291 acres were cropped, of which amount only 21,912 acres were irrigated. The actual resident population was

small. There were only 230 houses on the whole project, and a considerable number of these were inhabited by tenant farmers.

The vigorous colonization policy gradually brought in new settlers, and by 1930, the year of the Wilson Report, there were 777 water-users irrigating 69,807 acres. The district was attracting and holding population, in spite of the fact that the farmers in general had little or no equity in their land and small prospect of ever becoming owners. Much of the project was farmed under crop lease agreements, which gave the colonization manager considerable control over farming operations, and at least provided some assured return to the farmer.¹⁶ The project continued to grow during the early years of the depression, and in 1935 there were 848 water-users irrigating 73,022 acres.

Progress during the first ten years of operation was more apparent than real. It was made possible only because the Provincial Government had assumed the capital costs of the project and in addition was consistently advancing maintenance and operating costs against future collections. The system could not possibly have been kept in being had this not been done.

In 1935 construction of a sugar beet factory was commenced, and the Ewing Commission began the investigations which resulted in cutting down the price of land to an amount which its productivity could reasonably support. The average price for the land and water right combined was set by the Ewing Commission at approximately

¹⁶ The price set in 1927 was an average \$12 an acre for the land, plus a fixed \$55 per acre for the water right. The land contract would appear to have been usually amortized at 6 per cent over a ten-year period; the water-right contract was amortized at the same rate but over a fifty-year period. Sale contract normally provided

that the farmer should turn over to the District one-third of his crop, should reside on the land, break and prepare for crop the full irrigable acreage in the first year, sow at least 10 acres to alfalfa, and plant a shelter belt around his farm buildings.

\$17.00 per acre, almost exactly one-quarter of the prices set in the 1926 contracts. Collections began to rise rapidly as a result. By 1938 eighty-one contract holders had paid up in full for their land and water right, and crop leases were being generally converted into agreements for sale. Ten years later, in 1948, the colonization manager had sold the last of the lands which had come into his hands, and, out of the 1,087 contracts in force, 833 had been paid up in full.

Although the available farm land of the district had been almost completely taken up by the end of the war, population continued to increase. During 1947-48, sixty-two Dutch families—approximately 400 men, women and children—forty-seven families of displaced persons, and 155 single D.P's were absorbed in the district as hired help.

The successful colonization of the district would appear to have depended on the following factors:

(a) The ruthless reduction in the size of farm units. The Widtsoe Report had made it difficult for the average farmer to hold more than 320 acres. The predominant size of farm is the one-quarter section, each containing approximately 100 to 125 acres of irrigable land, with the remainder of the quarter classified as dry land. The next size in importance is the half-section. There are also a number of 80-acre farms, but these have proved usually less successful than the larger farms.

(b) The policy of "trial leases", which kept the district in production during the period of the depression, secured to the district revenues as much as the farmer could spare from his own livelihood, and yet avoided the accumulation of still more

unpayable debt against the land. This policy gave both the District Management and the farmer himself an opportunity to assess each individual's ability to adapt himself to irrigation techniques, and enabled the elimination of unsuitable settlers with a minimum of delay and waste.

(c) The firm collection policy, the supervision of farming methods, and the wise provision of short term loans at low interest rates to encourage diversification and to assist improvement, were all factors which made it possible for the district to attract and to hold good settlers, even under very trying conditions.

The experience of supplying irrigation facilities to settled districts in Alberta—Springbank, Lethbridge, United New West and Magrath each affords proof of one or more of these points—would seem to indicate the following principles:

1. Where dry farming is at all possible, settlers will welcome irrigation during a dry cycle; they will not use the irrigation facilities provided, and will evade responsibility for paying for these facilities if any opportunity for non-use or for evasion exists.
2. Unless the settlers are skilled irrigators, they will not reduce their land holdings to optimum size, nor will they follow sound irrigation practices, unless compelled to do so. Where such compulsion is applied honestly and impartially it will be accepted with fairly good grace, and will not result either in general abandonment of the District nor in serious disaffection.

3. No District has a reasonable prospect of success until land payments are brought into harmony with the productivity of the area.
4. If settlers are to survive the period of development, they must either possess considerable working capital or be able to obtain it at low rates of interest.
5. A District may survive, and pay at least part of its operating and maintenance costs, but it cannot become prosperous or make any worthwhile contribution towards its capital costs, until markets are developed for specialized, high-value crops, in the production of which irrigated land has a marked competitive advantage over non-irrigated land.

The larger irrigation developments in the province, the two C.P.R. projects, the Canada Land and Irrigation Co's venture, and at least part of the A.R. & I. system were built to provide irrigation facilities to unsettled areas which it was then necessary to colonize with suitable settlers.

The C.P.R. Western District illustrates what has happened in the past when an area suitable for dry farming is colonized as good agricultural land with supplementary irrigation facilities. The C.P.R. Eastern District provides an example of what has occurred when land naturally suitable only for grazing purposes is supplied with irrigation facilities and colonized for irrigation farming only.

In the Western and Central sections of its project, the C.P.R. sold approximately 202,000 acres of irrigable land at an average price of \$39.50 per acre, and 1,400,000

acres of non-irrigable land at an average price of \$13.20 per acre. Of these sales, at the end of 1937, some 500,000 acres were still unpaid for, and the amount outstanding was approximately \$20.00 per acre, indicating that payments were far in arrears on the irrigable land, but that most of the non-irrigable land had been fully paid for.

This land was sold in a vigorous campaign which stressed the advantages of irrigation farming; these advantages were further illustrated by the operation of an admirable demonstration farm at Strathmore, and by a tireless education campaign. The farmers remained, on the whole, unconvinced. They fought vigorously through their U.F.A. organization and as individuals to secure cancellation of their water contracts, reclassification of their land as non-irrigable, and exemption from the extra costs imposed on irrigable land. When the C.P.R. in 1946 eventually decided to abandon operation of the irrigation system, and to transfer the works without cost and accompanied by a considerable cash bonus to the water-users, a full three-quarters of the irrigable acreage was withdrawn from the re-organized project. On this section of the prairies, water added too little to the productivity of the land to warrant any appreciable payment for the irrigation facilities.

The story is significantly different in the case of the Eastern Irrigation District. This area was settled by the same agency and very largely by the same methods as the Western and Central sections. The type of settler attracted was very much the same—methods of administration and programs of education were identical. There were,

in fact, only two important differences: The first was that settlers in the Eastern Irrigation District were required to pay an annual water rate of \$1.25 an acre instead of only 50 cents an acre as in the Western District, and an increase of 150 per cent in annual water rates was a considerable item in the farmer's budget. The second significant difference was that climatic conditions in the Eastern Section made dry farming a hopeless proposition. The alternative here was not between irrigated and dry farming as in the Western District; it was a choice between the utilization of low-grade grazing land to support scanty numbers of livestock, and the use of the same land for irrigation farming.

These alternatives were open to settlers who remained in the district. There was naturally a third course open to settlers in either section of the project—they could abandon the attempt to farm in the Irrigation Block altogether and go elsewhere. This was the course followed by a very large number of those who bought land in the Eastern Block. The big influx of settlers had come to the district in the years immediately following World War I, and, in the summer of 1921, 1,140 farm units were occupied. The exodus began almost immediately. By 1924, 407 farms had been abandoned by their original purchasers. Lenient collection policies, reclassification of land on terms more favourable to the farmers, and very considerable reductions in the purchase price of the land failed to hold the farmers. New settlers could still be attracted by vigorous sales campaigns, but no sales campaign could keep them on the

land. Between 1927 and 1930, 524 new sales contracts were written, but the number of water-users increased by only 123.

The Western Section had been able to hold its settlers, for a good living could be made there, but it had been unable to make its settlers irrigate their lands. The Eastern Section had no difficulty in persuading its settlers to use irrigation water; it could not persuade them to continue as irrigation farmers. The chief discouraging factor was undoubtedly the high price charged for irrigated land. Even when prices were reduced in 1927 to approximately \$35.00 an acre, prospects remained very bleak. Irrigated land can be made productive only by a heavy expenditure of labour and of capital in levelling land, in the erection of fences and buildings, in stocking farms with good-quality livestock. Few of the immigrants had any capital beyond the small amount expended as a down payment on their land; many lacked even this, and had no equity in their farms whatever. Yet all permanent improvements carried out by the tenant—all levelling, fencing and building—became the property of the landlord. The tenant or buyer who made such improvements could only become their owner when his contract was paid out, some thirty-five years in the future, if he lived that long. There was small incentive to improvement, and until improvement had been carried out on a very considerable scale, productivity must remain low.

A third colonization project enjoyed a happier conclusion. At the south-eastern extremity of the Eastern Irrigation District is the Rolling Hills area, an irrigable pocket

for whose supply the C.P.R. had constructed the major irrigation works, but which had never been developed because of the scanty supply of settlers available for irrigated lands. In 1938 the old works constructed for this area were refurbished and extended by the Eastern Irrigation District, which has expended approximately \$300,000 on the development of the project. Part of this cost was met by a \$50,000 grant from P.F.R.A., but in return for the cash grant the Eastern Irrigation District credited each purchaser of land in the section who was sponsored by P.F.R.A. with a cash payment of \$2.00 an acre on his land contract. P.F.R.A. expended an additional \$21,000 in land levelling operations with power machines supplied by the E.I.D., and approximately 100 acres on each quarter section was broken before the arrival of the settlers. The latter began to arrive in the fall of 1939; by June of 1941, 104 farms were in operation. Approximately three-quarters of the settlers were farmers moved out of dried-out sections of Saskatchewan to make way for community pastures there. The remainder, for whom the northwest quarter of each section was reserved, were experienced irrigators, chiefly farmers' sons from the Eastern Irrigation District. The average capital possessed by the settlers was approximately \$1,000 per family, chiefly in the form of worn-out implements, salvaged fencing and building materials, and salvaged livestock. The nearest railway point was at Scandia, on a branch line fifteen miles from the district, accessible by dirt road. Another dirt road was constructed to reach the C.P.R. main line near Tilley.

The settlers selected their own land, and were given two-year leases with the option of purchase at the end of that period. If they then decided to buy, they were credited with \$2.00 an acre from the original P.F.R.A. grant. The remainder of the purchase price, \$8.00 an acre, was spread over the next twelve years, with interest at 5 per cent on all overdue payments. During the first two years of occupancy, under the lease option, the settler paid a nominal rental of \$10.00 per year, or, if a school district was formed to include the settler's land, of \$45.00 per year. One-half of the normal water rate on the full irrigable acreage was paid by the settler during his first year of occupancy. During his second year he paid the full rate, but only on the acreage actually cultivated; thereafter, if he converted his lease into a purchase agreement, he paid the full water rate on the surveyed irrigable acreage, regardless of the amount actually cultivated.

The Rolling Hills colonization project has been remarkably successful. Of the first 152 men established, only 16 signed quit claims and left the district, a turnover of only slightly more than 10 per cent in the first six years of operation. The project is now solidly established and prosperous. Average capital per farm increased from approximately \$1,000 per farm in 1939-40 to between \$5,000 and \$8,500 per farm in 1946, depending on the type of farming carried out.

Successful colonization here did not depend on the development of specialized crops; except for a small market for garden seeds, the district has had to depend on the unspecialized markets for livestock and grain, in which the comparative advantage enjoyed by irrigated land is minimal.

The success would appear to depend chiefly on three factors of policy, and one fortuitous factor.

In the first place, the very low price charged for irrigated land was probably the most important single factor in ensuring the success of the project. From the first, there was every prospect that the farmer could become the owner of the land and of all improvements which placed upon it. The incentive to improvement was strong and the rapid increase in the productivity of the district reflects the power of this incentive.

In the second place, the high proportion of experienced irrigators on the project ensured to every inexperienced man a neighbour on the adjoining farm who could supply advice and assistance.

In the third place, the very careful selection of settlers, and the preparatory work done in breaking and levelling land, both reduced the hardships of pioneering and ensured that the pioneers who had to submit to these hardships would be of a type not easily discouraged.

The fortuitous factor was the accident which established the settlement at a time when the prices for agricultural products were rising more rapidly than farming costs. No better time could have been chosen to initiate such a project than 1939-40.

The Financial Problem.—Alberta's major irrigation systems were built under a mistaken assumption—that irrigation would so increase the productivity of the land that both the costs of operation and the costs of construction would easily be repaid out of this increase.

The falsity of this assumption, so far as most of Alberta's irrigable acreage is concerned, is indicated in the following table:

Project	Capital Expense; Colonization, Drainage, Construction Cost, etc.		Written Off		Repaid by Contract Holders	
	Total	Per Acre	Amount	%	Amount	%
	\$	\$	\$		\$	
Western (C.P.R.)..	5,860,000	117.20	5,860,000	100	Nil	
Eastern (C.P.R.)..	12,952,964	46.26	12,952,964	100	Nil	
Taber.....	300,000	13.95	Nil	.....	300,000	100
Lethbridge Northern	5,400,000	57.52	4,770,000	88.4	630,000	11.6

In the interpretation of these figures, one should note that:

(1) The Western Irrigation District works were constructed to serve an irrigable area of 219,000 acres. Reduction of the District to less than one-quarter of this size has more than quadrupled the per-acre cost assessed against the land still retaining water right.

(2) The low construction cost per acre on a number of the smaller projects is misleading. While it represents the actual cost of the works operated by these districts, the water they use is carried for considerable distances through works belonging to other systems, and this carriage must be paid for. Thus the Taber Irrigation District pays 50 cents an acre for water delivered at its head-gates through the works of the old A.R. & I. system, and the New West Irrigation District pays the Canada Land and Irrigation Company \$1.25 per irrigable acre per year as a service charge for the delivery of its water through the Company's main canal.

(3) It is almost impossible to disentangle from the land sales accounts of the railway companies the amount which may fairly be classed as a return for capital expenditure. The C.P.R. transferred to the water-users, without charge, clear title to all its works and to considerable additional real estate and moveable property, and might reasonably be held to have written off the whole cost of the development. The railway company did, however, receive a considerable return from the sale of irrigable land. The premium charged for irrigable land above the price charged for dry land in the same District might logically be set off against the capital loss incurred in constructing the irrigation works.

(4) The accounts of the Lethbridge Northern System are particularly difficult to unravel, in such a way as to segregate capital losses from operating losses.

Collections from water-users from the first fell far behind the requirements of the District, and assistance was required if it was to continue operations.

Each year the District continued to set a rate, which, if paid, would meet requirements for operation, maintenance, sinking fund, bond interest and necessary reserves. The Provincial Government advanced to the District each year the full amount of this levy. Advances made in this way had reached a cumulative total of \$11,437,979.25 by the end of 1949.

The Provincial Government also expended slightly more than \$1,000,000 on behalf of the District, more than half of this amount being "colonization expense", and the remainder being expenditures for construction of

reservoirs, for the draining of lands and the prevention of seepage, and for the payments of arrears in taxes.

Finally, the Provincial Government in 1945 relieved the District of its debenture liability, of \$5,400,000.

The total Provincial outlay on behalf of the District to the end of 1949 thus amounted to \$17,837,979.29.

Offsetting this expenditure the Provincial Treasury had collected from the District a total of \$4,826,921.54 to the end of 1949. This sum represents payments for water rates, land contracts, interests, lease revenue, etc., and thus lumps together both capital and current items.

In addition, the Provincial Government took over from the District in 1945 \$2,199,230.58 which had been accumulated in a sinking fund for the retirement of debentures.

Total collections from the District thus amount to \$7,026,152.12; the Provincial Government's outlay exceeds this amount by \$10,811,827.13 or almost exactly double the capital cost of construction for the original system.

The average value of the irrigable land of the system was set by the Ewing Commission at \$17.00 per acre. Existing contracts were revised to this valuation, and new contracts were in accordance with it. All the land of the District has now been sold, and the great majority of the contracts have been paid out in full. If dry land values are arbitrarily set at \$10.00 an acre, then the water-users of the District may be credited with approximately \$7.00 an acre on 90,000 irrigable acres, or \$630,000 as their contribution towards the capital cost of the system. The capital loss

assumed by the Province would then be assessable at \$4,770,000 and the remainder of the provincial outlay, \$6,041,827.13, would represent an average annual operating loss of \$223,916.43 during twenty-six years of operation.

The District would appear to be out of danger financially now, and should not require any further outlay of provincial funds. There is still a small amount due the Provincial Treasurer for land sales and uncollected loans, interest and other items, but any proceeds from this source might wisely be added to the reserves of the District, since these are still rather inadequate in case of emergency.

In addition to the heavy capital loss outlined above, the operating losses on the major irrigation projects in Alberta have been very heavy. Their magnitude on two such projects is illustrated in the following table:

Project	Period	Total Operating		Yearly Average	
		Loss OR Profit		Total	Per Acre
		\$ cts.	\$ cts.	\$ cts.	\$ cts.
Eastern (C.P.R.)..	1929-34	2,994,213 94	.....	499,035 66	4 82
Eastern (I.D.).....	1935-48	.....	111,731 60	7,980 83	0 00
Lethbridge Northern..	1924-49	6,041,827 13	.....	223,916 43	2 49

Financial results from these projects have been discouraging but Albertans have the dubious consolation that at least they were no worse here than elsewhere.

With the single regrettable exception of the Springbank Irrigation District, the early activity in irrigation development in Alberta

was entirely in the hands of private companies, and public opinion was quite content with this condition. Experiments in state assistance for irrigation projects then being carried out in the United States, first under the Carey Act and subsequently by the Federal Reclamation Bureau, were naturally attracting attention, and support for similar experiments in Canada was voiced by certain delegates from British Columbia at the second annual convention of the Western Canada Irrigation Association. No support came from the Alberta delegates. J. S. Dennis asserted that Government irrigation in the United States was a failure, and that the time for such schemes would never come to Canada. This view was heartily endorsed by R. B. Bennett, who was strongly opposed to employing either Government funds or Government credit to finance irrigation developments.

As the prospects for profitable private investment in irrigation projects faded, opposition to public investment faded too. At the sixth convention of the Association, 1913, A. E. Ashcroft strongly recommended (a) legislation to facilitate the creation of irrigation districts, (b) government guarantees to assist the sale of irrigation district debentures, (c) direct government expenditure on the construction of major reservoirs, and (d) government expenditure for the construction of irrigation works in regions not sufficiently developed to form irrigation districts. These recommendations were well received by the convention, and J. S. Dennis himself, though calling attention to the failure of the Wright Act in California and of the Northwest Irrigation Ordinance on the Prairies, moved a resolution urging the

British Columbia government to explore the possibility of creating irrigation districts. Enabling legislation of this kind was adopted by British Columbia in 1914 and by Alberta in 1915. When F. H. Peters, Commissioner for Irrigation in the Department of the Interior, presented a paper at the 1916 convention of the Association, predicting a brilliant future for irrigation district development, there was no opposition in principle from any of the delegates. At the same time the assembled irrigators had no doubt that each district would be able to stand on its own feet financially, both in borrowing money for development and in paying it back. There was still no suggestion of the propriety of provincial or Dominion assistance to irrigation districts, and for the development of unsettled areas the private corporation appeared to be the only acceptable agency.

This optimism was somewhat tempered in 1920. The Alberta Irrigation Districts Act was revised in that year to permit the formation of the Lethbridge Northern Irrigation District, but the New District could find no buyer for its debentures, even when supported by a partial guarantee from the Province. To make the venture possible the Provincial Government was forced to guarantee the bonds unconditionally, both as to principal and interest, and even then the sale was accomplished only at a serious discount. There was still no retreat from the principle that irrigated land must pay the whole cost of its own development.

"The Government is so satisfied that these lands can carry the burden imposed upon

them", L. C. Charlesworth, Chairman of the Irrigation Council, assured the 1921 convention of the Irrigation Association, "that it is willing to put the whole credit of the Province behind the bonds to enable these people to get the money."

"This guarantee", A. Griffin assured the same meeting, "is not intended to relieve the District of one iota of responsibility for one cent of payment when it is due."

In spite of these vigorous declarations of policy it became increasingly clear that many of the new irrigation districts, like the old development companies, would find it impossible to recover the entire cost of irrigation development from the irrigated lands. The discovery which Alberta was making had already been made in the United States. On April 21, 1924, President Coolidge submitted a message to Congress recommending:

- (a) That the Federal Government should write off as irrecoverable both a capital expenditure of \$18,961,146 and a further anticipated loss of \$8,830,000.
- (b) That charges for water use and irrigation should be based solely on the productivity of the irrigated lands, without regard either to construction costs or to operating costs.

Ten years later, similar conclusions were being reached in Alberta. The Ewing Commission in 1935 based payments for irrigated lands in the Lethbridge Northern system on what farmers could afford to pay, regardless of costs incurred in development and construction. In the same year, the C.P.R. wrote off its capital and operating losses in the Eastern Irrigation District and surrendered that system and all its assets to the water-users, to operate as best they could.

The principle that the entire cost of irrigation development must be paid by the farmer regardless of the productivity of his land has

now been generally discarded in Alberta. The present formula is that the farmer should pay for the costs of irrigation development whatever the increased productivity of his land will permit him to pay. In some cases, as in that of the Taber Irrigation District, the increase in productivity has been so great that the farmers have been able to pay the entire costs of the development. In other cases such as the Lethbridge Northern Irrigation District, the increase in productivity has been so small that the farmers have been able to meet only a small part of the costs of development and the remainder has been borne by the general taxpayers of the Province.

The difficulty with both formulas results from the fact that the farmer receives only a fraction of the total increase in productiv-

ity which results from irrigation development. The remainder of the benefits from irrigation are spread very widely through the nation. They represent increased revenues to railways and to other carriers, increased sales to all producers who share the expanded market created in the irrigated communities, and increased supplies of consumer goods to the public at large which draws an increasing proportion of its food supplies from the irrigated lands. They mean larger payrolls, greater profits, higher tax returns and lower living costs in widely separated segments of society. The assessment of these remote returns, and the determination of the proportion of the cost of irrigation development properly chargeable to the farmer on the one hand and on the other to more remote beneficiaries is a baffling problem.



Legal and Constitutional Aspects

The Problem of the South Saskatchewan River Development Project. A memorandum by John J. Connolly, Q.C.

THE purpose of this memorandum is to set out the scope of the Commission's responsibilities having regard particularly to legal questions that may arise. The South Saskatchewan River is an interprovincial river and in its upper reaches some of its tributaries cross the international boundary. It is proposed to discuss the existing condition of the law which touches problems connected with its development. It is also proposed to consider problems with reference to legislative competence.

The three Prairie Provinces acquired the right to control the bulk of their natural resources by agreements with the Dominion Government in December 1929 and March 1930. These agreements were confirmed by legislation of the Parliament of Canada in 1930, and the Canadian legislation was ratified later by the Imperial Parliament. It is important to understand the effect of these agreements.

Before these three provinces were constituted certain lands, including, of course, waters and water powers in that area, were owned by the Crown in right of Canada. When the Prairie Provinces were established, these lands, water powers and so forth were

not handed over to the administration of the provincial authority but were retained by the federal Crown. In summary, the effect of the agreements in 1930 was merely to transfer the lands and properties still held by the Crown and administered by the federal authority, to the administration of the provincial authorities. The 1930 federal legislation conferred no new sources of legislative jurisdiction upon the legislatures of any of the provinces concerned. All that the 1930 legislation accomplished was to transfer to the several provincial authorities concerned, additional Crown assets to be administered by them, subject to the provisions of the several agreements, and administration by the federal authority came to an end.

It is to be borne in mind that the federal government had granted lands prior to 1930 to private individuals. These grants, of course, were not disturbed by the 1930 agreements. As regards the ownership of lands and water powers in the Prairie Provinces, the position prior to 1930 was that they were owned, to some extent, by private individuals who had acquired the lands under grants from the Crown, the C.P.R., the Hudson's Bay Company or other private individuals, and there were lands and water powers owned by the Crown and administered by the federal authority. The lands owned by

the Crown in right of the provinces and administered by them were comparatively insignificant. After 1930 certain lands and water powers continued to be held by private individuals, but virtually all the remaining lands owned by the Crown came under the administration of the several provincial governments. The 1930 legislation, therefore, gave to the governments of each of the three Prairie Provinces new assets to administer but it did not give them any new sources of legislative powers.

There may be a misunderstanding arising out of the use of the term "natural resources". It appears to be considered that the agreements of 1930 transferred to the provinces all the natural resources in the provinces as a matter of ownership and all legislative power in relation to them. In fact, as already indicated, they transferred only certain assets and did not change the distribution of legislative power. The confusion arises in the use of the term "natural resources" in two ways. In a political sense, the Natural Resources Agreements of 1930 transferred from the federal Crown to the provincial Crown the right or power of administration over all natural resources in the said provinces then still unalienated by the federal Crown. The effect of the legislation was to give the Prairie Provinces the same power with respect to the natural resources within their boundaries as the original provinces to Confederation acquired by virtue of Section 109 of the B.N.A. Act. In the political sense, therefore, the provinces acquired their natural resources in 1930. In a legal sense, however, as already indicated, it was merely a transfer of the

administrative rights over the remaining assets without affecting legislative power.

Following the depression and the drought of the early Thirties, the federal government decided that some special action was required for the relief of people in the Prairie Provinces. Accordingly in 1935 the federal Parliament enacted the Prairie Farm Rehabilitation Act as Chapter 23 of that year. The Act was amended in 1937 by Chapter 14 of the Statutes of that year. The purpose of the legislation is best expressed by the following excerpts from the Act as amended.

"4. The Advisory Committees shall consider and advise the Minister as to the best methods to be adopted to secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta, and to develop and promote within these areas systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security, and to make such representations thereon to the Minister as the Advisory Committees may deem expedient.

10. The Minister may,

- (a) subject to section four of this Act, undertake the development, construction, promotion, operation and maintenance of any project or scheme under or by virtue of this Act, or enter into agreements with any province, municipality or person with respect thereto.
- (b) pay all necessary administrative expenses incurred under the Act

and all necessary travelling and living expenses incurred by officials or employees in performance of their duty.

(2) No single project or scheme under this section involving an expenditure in excess of ten thousand dollars in any fiscal year shall be undertaken without the consent of the Governor in Council.

11. The Minister may, for the purposes of this Act, and with the approval of the Governor in Council, purchase, lease or otherwise acquire, or sell, lease or otherwise dispose of, any lands or premises which may be required for or included in any project or scheme, upon such terms or conditions as he may deem desirable."

Under date of June 19, 1947, P.C. 2298 was passed by the federal government. This order in council laid down certain principles to govern the policy of the federal government in connection with the construction of large water development projects by the P.F.R.A. organization if the same were approved by the Governor in Council. The pertinent parts of P.C. 2298 are as follows:

"1. Before Canada undertakes the construction and operation of a project it will be necessary for the province in which the project is located to enter into an agreement:

- (1) to transfer any water rights required for the construction and operation of such project;
- (2) to make available to Canada any Provincial Crown lands which may be required for dam site,

reservoir or canal right-of-way purposes in connection with such project.

- (3) under which the water will be utilized by the Province or some other authority or organization on the terms set out in such agreement.
2. Canada will operate any project constructed pursuant to this policy in such a way as to maintain so far as possible the minimum flow determined by the Prairie Provinces Water Board for the stream upon which the project is constructed;
3. Canada will make a legal survey of any lands necessary for the construction, operation and maintenance of the portion of any project to be constructed by Canada pursuant to this policy and will file a plan or plans of such survey in the appropriate Land Titles Office and in the Water Resources Office of the Province.
4. In the construction of an irrigation project hereunder Canada will undertake and assume responsibility for the construction of the main reservoirs and any connecting canals, and will be responsible for the maintenance and operation of such works; Canada will deliver to the Provinces such water as it is agreed the Province will utilize at such place and for such fee as may be agreed upon between Canada and the Province. If the Province does not desire to utilize all of such water Canada may enter into

arrangements with others for the delivery and use of any water not taken by the Province."

Many agreements have been concluded between the Dominion on the one hand, and each of the four Western Provinces on the other, to carry out recommendations made under the P.F.R.A. Some of these agreements were made prior to the passage of P.C. 2298. Some projects were very small. Others like the St. Mary River Irrigation project were very substantial undertakings. I think it proper to say that projects undertaken under the P.F.R.A. have all been special projects designed to afford relief and assistance in the light of circumstances existing at the time. It does not appear that any special attention was paid to the legal rights of riparian owners downstream to the location of the project in question. In any event, the projects proposed and developed, do not appear to have been part of an overall plan designed to be in the best interests of all the Prairie Provinces or of Canada as a whole. This is not to say that the projects planned and completed were not in the interests of the Prairie Provinces at large and of Canada. It is to say, however, that the approach to the various schemes of development under the P.F.R.A. was not made from this point of view as set out in the Order in Council establishing this Royal Commission and which must govern the recommendations which the Commission is to make.

At this point it is perhaps important to consider the Prairie Provinces Water Board. P.C. 2297 of June 19, 1947, is an Order in Council authorizing the Dominion Minister

of Agriculture to execute an agreement with the Governments of Alberta, Saskatchewan and Manitoba to establish the Prairie Provinces Water Board. It will be convenient to outline here the recitals contained in that Order in Council.

"WHEREAS the construction of water development projects in the Provinces of Alberta, Saskatchewan and Manitoba involves the use of inter-provincial waters;

AND WHEREAS no provision has been made for determining the allocation of the said waters between the provinces; AND WHEREAS it is desirable that the most beneficial use be made of the available water resources of the three Prairie Provinces;

AND WHEREAS it is considered desirable by agreement with the Governments of the Prairie Provinces to establish a Board for the purpose of allocating the said waters and making recommendations as to their beneficial use;"

The agreement which the Minister of Agriculture was authorized to complete under P.C. 2297 was dated July 28, 1948. The following are extracts from that agreement which bear upon the questions herein discussed.

"1. Manitoba, Saskatchewan and Alberta and Canada agree to establish and there is hereby established a Board to be known as the Prairie Provinces Water Board to consist of five members to be appointed as follows:

- (a) two members to be appointed by the Governor General in Council, one on the recommendation of the Minister of Mines and Resources, and one, who

shall be Chairman of the Board; on the recommendation of the Minister of Agriculture;

- (b) one member to be appointed by the Lieutenant Governor in Council of each of the Provinces of Manitoba, Saskatchewan and Alberta.

"2. Functions

The functions of the Board shall be to recommend the best use to be made of inter-provincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta and to recommend the allocation of water as between each such province of streams flowing from one province into another province.

"3. Composition of Board

The members of the Board shall be chosen from those engaged in the administration of water resources or related duties for Manitoba, Saskatchewan, Alberta or Canada, as the case may be, and shall serve as members of the Board in addition to their other duties.

"4. Duties of Board

The duties of the Board shall be as follows:

- (a) to collate and analyse the data now available relating to the water and associated resources of interprovincial streams with respect to their utilization for irrigation, drainage, storage, power, industrial, municipal, navigation and other purposes;
- (b) to determine what other data are required from time to time in order to reach decisions on questions referred to it and to make recommendations to the appropriate governmental organizations concerned for the carrying out of such field surveys, power

investigations, soil surveys, establishment of gauging stations, economic studies relating to drainage and flood control and all similar work which the Board considers necessary to supply information required for the proper performance of its duties;

- (c) upon the request of any one of the three Provinces or the Dominion to recommend the allocation of the waters of any interprovincial stream among the respective Provinces;
- (d) to report on any questions relating to specific projects for the utilization or control of common river or lake systems at the request of one or more of the Ministers or authorities charged with the administration of such river or lake systems.

"5. Confirmation of Board's Recommendations

A recommendation of the Board with respect to any matters referred to it under Subsections (c) and (d) of Section 4 hereof shall become effective when adopted by Orders in Council passed by Canada and by each of the Provinces affected thereby.

"9. Reports

The Board shall submit an annual progress report outlining work done and work contemplated in the agreed program to each of the responsible Ministers of the parties hereto and such other reports as may be required by any one of such Ministers.

"11. Each of the parties hereto agrees that it will not within the limits of its jurisdiction construct or permit the construction of any project that will interfere with the allocation

of waters resulting from a recommendation of the Board duly adopted pursuant to Section 5 hereof.

"12. Any water development project already constructed or to be constructed by any one of the parties hereto shall be so operated as to maintain as far as possible the allocation of water determined by the Board."

It is apparent that the functions of the Prairie Provinces Water Board are advisory. The members of the Board are public servants employed by the various interested governments. As a result of the terms of section 5 of the agreement, the proposals of the Board become effective only after each of the governments who are parties to the agreement implement the recommendations. Thus each government interested has a veto power under the agreement for every recommendation.

I understand that there has been some discussion before the Prairie Provinces Water Board on the merits of the South Saskatchewan River project as outlined in the report of the P.F.R.A. dated April 2, 1951. No decision has been reached.

It is now important in the light of this background to consider P.C. 4435, dated August 21, 1951, which is the federal Order in Council appointing this Commission. The terms of reference are as follows:

"... to conduct an inquiry into the following matters, namely:

Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;

Whether the said project represents the most profitable and desirable use which can be made of the physical resources involved."

The following paragraph is of importance.

"6. That the Commissioners be further authorized to include in their examination and to report upon all matters which the Commissioners may consider pertinent or relevant to the general scope of the inquiry."

These terms of reference are very broad. Under them, the Commission is charged with making a report to the Federal authorities on the "most profitable and desirable use" which can be made of the resources in question, in the interests not only of the people of the Prairie Provinces, but of the Canadian people as a whole. This work might have been done by the P.F.R.A. organization. It might have been done by the P.P.W.B.

The findings of the Commission do not commit the Federal Government to implement the report. It might be accepted, rejected or modified. Likewise, of course, the report would not commit any Province to any action.

If there is disagreement among the authorities of the various Provincial Governments concerned, as to their several rights to the consumptive use of the water of the South Saskatchewan River, that disagreement must not deter the Commission from making its report as P.C. 4435 demands. "The most profitable and desirable use which can be made of the resources involved" will take into account such factors as economics, costs, engineering, best land uses, hydro-electric power, alternative sources of power available, up and down river interests and the effect of varying these in the interests of the community as a whole, and the like. When this report is made the parties concerned would be in a position to consider its implementation.

The Commission, however, should be aware of the position in law.

In view of the fact that some of the tributaries of the South Saskatchewan River have their origin in the United States, there is an international aspect to the problem. Through the International Joint Commission the American authorities have claimed a certain quantity of the water in the resource as their own. The amount is relatively small. However, it should be pointed out to this Commission that all the water in the system is not available for use in Canada, and accordingly any allocation made in Canada should respect an allocation made by the International Joint Commission for consumption in the United States.

The allocation of water from the resource among the three Prairie Provinces raises legal questions and questions of jurisdiction. Expressions like "Provincial Rights", "The Rights of the Provinces to control their own natural resources", "The Rights of the Provinces to legislate in respect of 'Property and Civil Rights in the Province' " coupled with the 1930 Federal Legislation which returned to each of the three Prairie Provinces control over the great bulk of their natural resources, may engender the opinion that each of these provinces has certain vested rights in the resources in question which could forestall their development in the interests of the Prairies and of the country at large. To understand the position on this point it is important to know what the Provinces are before the law.

Provinces are not sovereign states, they are not legal persons. In one sense they are geographical areas defined by statute. In

another sense the term "province" is applied to the governments established by statute for those areas, and having certain legislative, executive and administrative functions. Among their other powers these governments have authority to administer certain Crown property, and the right to administer this property has been conferred upon them by appropriate legislation. Other Crown property is administered by Federal authorities. For example, when the Crown in the right of the Province transfers land to the Crown in the right of Canada, there is no real conveyance of property since Her Majesty remains the owner in either case. What takes place is merely a change in administrative control.

It is elementary to say that the Crown is still the same person in Alberta, Saskatchewan and Manitoba. The properties owned by the Crown, however, in each of these Provinces are administered by different authorities. In some cases the authority is Provincial, in other cases the authority is Federal. For example, the Crown is the owner of the beds of navigable streams, also of the foreshore thereof. Such property of the Crown is administered by the provincial authorities. The Crown may be the owner of harbours which were in existence in 1867, of lands for post offices, and the like. Such Crown property, also owned by Her Majesty, is administered by Federal authorities. The Crown in the right of Canada or in the right of the Province can be and no doubt is, the owner of land bordering on interprovincial streams, i.e. a riparian owner.

All property is owned either by the Crown or by other legal persons. The fact that the

province as such is not the owner of Crown property administered by the province, but that it is owned by Her Majesty establishes certain legal premises and raises certain legal difficulties. For example there can be no rights between the provinces with reference to Crown property, because the owner in each case is Her Majesty, and she cannot have rights against Herself.

There is ample authority for the statement that the rules of common law apply to the Crown except as varied by Statute. It is equally clear that the rules of common law, except as varied by Statute, govern rights asserted by riparian owners other than the Crown to the consumptive use of water in streams.

The common law rules as to the rights of riparian owners are not complex. It has been settled that the right to the enjoyment of a natural stream of water on the surface, *ex jure naturae*, belongs to the proprietor of the adjoining lands, as a natural incident to the right to the soil itself, he has the right to have it come to him in its natural state, in flow, quantity and quality, and to go from him without obstruction; upon the same principle that he is entitled to the support of his neighbour's soil for his own in its natural state. These riparian owners rights are not founded on the ownership of the bed of the river, but upon right of access to the water. No riparian proprietor has any property in the water itself except in that particular portion which he may choose to abstract from the stream to take into his possession, and that during the time of his possession only. Under certain circumstances, and provided no material injury is done, the water may be used and

may be diverted for a time by the upper owner for the purpose of irrigation. The lower riparian owner is entitled to the accustomed flow of the water for the ordinary purpose for which he as a riparian owner can use the water. The Latin maxim covering the right to water is stated "*sic utere tuo ut alienum non laedas*".

This is a summary of the common law position. This is the position apart from Statute.

As between say Saskatchewan and Alberta, or as between Manitoba on the one part, and Alberta and Saskatchewan on the other, it can well be argued apart from Statute that the rights with reference to the use of the water are covered by the common law as aforesaid. In this background John Smith living in Manitoba could at common law succeed on an application for an injunction and on a claim for damages, if proved, arising out of a diversion for consumptive use by a riparian owner in Alberta who had diminished the natural flow of the South Saskatchewan River in front of his property. It might well be asked if the common law doctrine of riparian rights runs beyond the Provincial boundary. There would appear to be no authoritative decision on the precise point. Statutory law, however, can change the common law rules, and specifically, valid statutory law can change the common law rules to confer a right of diversion of water for consumptive use.

If a diversion for consumptive use in any of the three Prairie Provinces from the South Saskatchewan River is to be authorized, and the common law rule abrogated, the question arises as to what legislative body is competent to enact the required legislation. By

subsection 13 of Section 92 of the British North America Act a provincial legislature may make laws respecting "Property and Civil Rights in the Province." Thus Alberta may legislate to prevent an action by an Eastern Alberta riparian owner against a Western Alberta authority which would diminish riparian rights of the Eastern Albertan.

However, it is not competent for a provincial legislature to legislate with reference to property and civil rights "outside" the province. The Privy Council has held that the legislature of the Province could not legislate validly in derogation of a civil right outside the province. In other words, it can be argued that such legislation as above mentioned by the Province of Alberta would not be effective to deprive a Saskatchewan resident of his riparian rights against an Alberta authority which infringed them.

While it cannot be determined with any great certainty what legislative body, Federal or Provincial, is competent to enact suitable legislation to vary the common law, in certain circumstances the Federal government could assert jurisdiction.

For example, the Federal parliament might declare a project for the development of the resource in question to be a work "for the general Advantage of Canada or for the Advantage of two or more of the Provinces", under Section 92 (10) (c) of the B.N.A. Act. Such a declaration would give the Federal authority jurisdiction. In certain circumstances it might be possible for the Federal authority to claim jurisdiction under the general powers contained in Section 91 of the B.N.A. Act. This enables the Federal authority to make "laws for the Peace, Order, and

Good Government of Canada, in relation to all Matters not coming within the Classes of Subjects by this Act assigned exclusively to the Legislatures of the Provinces." It is to be noted that this is not a matter assigned exclusively to the legislatures of the Provinces by the B.N.A. Act.

It should be pointed out also that the Federal Government in certain circumstances would have authority under Sections 56 and 90 of the B.N.A. Act to disallow legislation by one provincial authority if that legislation is in derogation of rights existing in another province.

At the hearings in Saskatchewan it was contended on behalf of the Government of that Province, that the doctrine of "equitable apportionment" which applies in certain jurisdictions in the United States, should be the doctrine to be applied to this interprovincial river. It was admitted, however, by Counsel for the Government of Saskatchewan that the doctrine in question is not the law in Canada. It was proposed that it should be the principle used and that this condition should be brought about through agreements with the various Governments concerned.

In addition I should point out that it was part of the agreements concluded between the Dominion and the four Western Provinces when the administration of their assets was handed over to the provincial authorities, that all contracts and leases for the alienation of resources made by the Dominion prior to the transfer should be honoured. This is a factor which should receive appropriate consideration.

It is obvious from the above that there is great uncertainty as to the legal position

and as to jurisdiction. Perhaps this is not unusual in a new country. There may be further complications arising from conditions of land tenure in the West e.g. the rights of the Hudson's Bay Company, of the Crown in the right of the Dominion, of the rights acquired by the C.P.R. and others. The position of the Federal authorities with reference to navigation rights is a further possible complicating factor. There may be others.

I therefore suggest that the Commission make its finding as required by P.C. 4435. Such findings should touch upon problems of economics, costs, engineering, irrigation, and other matters. I think it might be

stated the Commission is advised that to carry out its recommendations may involve the solution of complex legal problems and problems of jurisdiction about which there is at present considerable uncertainty. It might be added that it is thought the scope of the Commission's terms of reference do not include the making of suggestions to solve these problems, but that if the Commission's findings are to be implemented, no doubt such legal and jurisdictional obstacles can be overcome. I think it should then be left to the authorities concerned to solve the legal and jurisdictional problems if they could agree on the report of the Commission as made or as they might agree to vary it.

Legal Aspects of the South Saskatchewan River Development Project. A memorandum by H. Carl Goldenberg, Q.C.

THE proposed development of the South Saskatchewan River for irrigation and power purposes in the Province of Saskatchewan invites consideration of the respective rights of the three Prairie Provinces in the waters of this interprovincial river. These rights are subject to such rights as the United States may have in the headwaters of the river and to the rights of Canada under the Navigable Waters Protection Act, which are not here considered.

The South Saskatchewan, with its headwaters in Montana and southern Alberta, flows into Saskatchewan where, north of Saskatoon, it joins with the North Saskatchewan to form the Saskatchewan River which flows into Lake Winnipeg, in Manitoba, and by the Nelson River empties into Hudson Bay. Works erected on the South Saskatchewan for irrigation or power pur-

poses within the boundaries of one province may, therefore, affect the flow of water into another province.

Before 1930 control of the water resources of the Prairie Provinces vested in the Government of Canada and such waters were under a single administration. With the transfer of the natural resources to these provinces in 1930, the single control and administration was replaced by divided control in that Manitoba, Saskatchewan and Alberta acquired jurisdiction over the waters within their respective boundaries. Each of the provinces established a separate water administration office.

Having regard to the common interest of the three provinces in the waters of the river system and to avoid interprovincial disputes which might arise from water diversions in any one province, the formation of an interprovincial board to recommend the best uses of the water and its allocation was discussed shortly after the transfer of the resources to

the provinces, but a satisfactory agreement could not then be reached. Some years later Manitoba became concerned with the possible effects of large water diversions in Alberta upon lake levels and water power possibilities in the lower regions of the drainage basin and an agreement for the creation of an interprovincial board was reached in 1945. As this agreement failed to give recognition to participation by the Government of Canada in financing irrigation projects, the interprovincial board was in 1948 replaced by a Federal-Provincial board under the name of the Prairie Provinces Water Board.

The agreement of July 28, 1948, between the governments of Canada, Manitoba, Saskatchewan and Alberta, which provided for the establishment of the Prairie Provinces Water Board consisting of representatives of each of these governments, declared that:

"The functions of the Board shall be to recommend the best use to be made of interprovincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta and to recommend the allocation of water as between each such province of streams flowing from one province into another province."

Among the duties of the Board are the following:

"upon the request of any one of the three Provinces or the Dominion to recommend the allocation of the waters of any interprovincial stream among the respective Provinces;

"to report on any questions relating to specific projects for the utilization or control of common river or lake systems at the request of one or more of the Ministers or authorities charged with the administration of such river or lake systems."

A recommendation of the Board on any of the matters referred to it under the two fore-

going sections of the agreement becomes effective when adopted by Orders in Council passed by Canada and by each of the provinces affected thereby.

A number of projects submitted for the recommendation of the Board affecting waters allocated by the governments of Canada and of the provinces prior to the formation of the Board have been approved and duly confirmed. When, however, an allocation of water for the South Saskatchewan project was requested by Saskatchewan in 1951, Alberta's representative presented an alternative project for consideration and, supported by Manitoba's representative, submitted that it was the function of the Board not merely to allocate water having regard to the available supply, as submitted by Saskatchewan, but also to take into consideration the economics of the proposed projects having regard to the most beneficial use of the water. The resulting disagreement as to the functions of the Board has been referred to each of the governments for its consideration.

In its submission to the Royal Commission on the South Saskatchewan River Development the Government of Alberta has drawn attention to this interprovincial problem as it affects the proposed development. Manitoba, pointing out that its share of the Saskatchewan River is "the residue remaining after approved appropriations are made effective in other provinces", has also drawn attention to the possible adverse effects of the proposed development upon its resources through a decline in the potential capacity of the power sites on the Dauphin and Nelson Rivers.

With the assertion by each of the provinces of its rights to the use of the surface waters of the river system, and a reference by the Government of Alberta to possible legal disputes similar to those which have arisen in connection with the use of interstate waters in the United States, it becomes necessary to consider the nature of the rights thus asserted. These rights, as such, do not appear to have been adjudicated by the Canadian courts but the corresponding rights of the States have given rise to considerable litigation in the United States. It may, therefore, be useful to examine the jurisprudence in cases arising from the diversion and use of waters in interstate streams.

The decisions of the Supreme Court of the United States have been based upon the principle of "equitable apportionment" of interstate waters. "On the basis of equality of rights, this doctrine fits the decision to the facts of the controversy, without adherence to any particular formula. The doctrine stems from the 1907 opinion in *Kansas v. Colorado*.¹ Kansas claimed the right to have the water of the Arkansas River flow into Kansas undiminished in quantity and unimpaired in quality. On the other hand, Colorado denied that it had in any substantial manner diminished the flow of the Arkansas River into Kansas. The Court found that, while Colorado had diminished the flow into Kansas by appropriation for irrigation purposes, the result had been reclamation of large areas in Colorado and that the ensuing diminution in flow

had caused little if any detriment in Kansas".² Accordingly, the Court refused to enjoin Colorado, saying that:

"We must consider the effects of what has been done upon the conditions in the respective States and so adjust the dispute upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream."³

In delivering the opinion of the Court, Mr. Justice Brewer said that notice must be taken that the local law of Kansas governing water rights was the Common Law doctrine of riparian rights and, further, that it recognized the right of appropriating waters for irrigation subject to the protection of the equal rights of other riparian proprietors. The Court therefore held that:

"As Kansas thus recognizes the right of appropriating the waters of a stream for the purposes of irrigation, subject to the condition of an equitable division between the riparian proprietors, she cannot complain if the same rule is administered between herself and a sister State."⁴

In the case of *Wyoming v. Colorado* (259 U.S. 419) the State of Wyoming sued the State of Colorado to prevent a proposed diversion in Colorado of the waters of the Laramie River, a non-navigable interstate stream, for purposes of irrigation. In both states the law governing water rights was not the Common Law doctrine of riparian rights but the statutory doctrine of "prior appropriation" under which priority of appropriation gives superiority of right. In

¹ 206 U.S. 46.

² Water Resources Law: Report of the President's Water Resources Policy Commission, Vol. 3, 1950, pp. 59-60.

³ 206 U.S. 100

⁴ 206 U.S. 104-105.

delivering the opinion of the Court, Mr. Justice Van Devanter said, at p. 466:

"The contention of Colorado that she as a State rightfully may divert and use, as she may choose, the waters flowing within her boundaries in this interstate stream, regardless of any prejudice that this may work to others having rights in the stream below her boundary, can not be maintained. The river throughout its course in both States is but a single stream wherein each State has an interest which should be respected by the other."

And at p. 484:

"The question here is not what one State should do for the other, but how each should exercise her relative rights in the waters of this interstate stream. Both are interested in the stream and both have great need for the water. Both subscribe to the doctrine of appropriation, and by that doctrine rights to water are measured by what is reasonably required and applied. Both States recognize that conservation within practicable limits is essential in order that needless waste may be prevented and the largest feasible use may be secured. This comports with the all-pervading spirit of the doctrine of appropriation and takes appropriate heed of the natural necessities out of which it arose. We think that doctrine lays on each of these States a duty to exercise her right reasonably and in a manner calculated to conserve the common supply."

The rule of equitable apportionment was followed in the case of *New Jersey v. New York* (283 U.S. 336). In delivering the opinion of the Court, Mr. Justice Holmes said, at p. 342:

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to the destruction of the interest of lower states could not be tolerated. And on the other hand equally little could New Jersey be permitted to require New York to give up its power altogether in order that the River might come down to it undiminished. Both States

have real and substantial interests in the River that must be reconciled as best they may be. The different traditions and practices in different parts of the country may lead to varying results, but the effort always is to secure an equitable apportionment without quibbling over formulas."

In *Hinderlider v. La Plata River and Cherry Creek Ditch Co.* (304 U.S. 92) the Supreme Court again applied the principle of equitable apportionment. In this case the Court had to consider a compact between the States of Colorado and New Mexico providing for an equitable apportionment of interstate waters to secure the greatest beneficial use thereof. In delivering the opinion of the Court, Mr. Justice Brandeis spoke favourably of such interstate compacts, pointing out, at p. 105, that "resort to the judicial remedy is never essential to the adjustment of interstate controversies, unless the States are unable to agree upon the terms of a compact, or Congress refuses its consent."

In *New York v. New Jersey* (256 U.S. 96) the Court also suggested that interstate water disputes might be better solved by interstate compacts:

"We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal presented by the large and growing populations living on the shores of New York Bay is one more likely to be wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceedings in any court however constituted."

In its decisions on the rights of States to divert and use waters in interstate streams, the United States Supreme Court has thus established that:

- (a) The waters of a non-navigable stream rising in one State and flowing into an

adjoining State may not be disposed of by the upper State as it may choose regardless of any injury or prejudice to the lower State;

- (b) Each State has an interest in the common stream which must be respected by the other and such interests must be reconciled as best they may be;
- (c) Each State is entitled to an equitable apportionment of the waters of the common stream;
- (d) Equitable apportionment does not necessarily imply an equal division of the water but is to be determined by the facts of the case and not by adherence to any particular formula;
- (e) It is not unreasonable to enforce against a State its own local rule governing water rights, although in *Connecticut v. Massachusetts* (282 U.S. 660) the Court pointed out that "while the municipal law relating to like questions between individuals is to be taken into account, it is not to be deemed to have controlling weight" in suits between States.

The Supreme Court has also suggested resort to interstate compacts as a more satisfactory means of settling disputes arising from the use of waters in interstate streams.

In the absence of Canadian precedents, the rules laid down by the United States Supreme Court may usefully be considered, in so far as they may be applicable, in determining the rights of the three Prairie Provinces to use the surface waters of an inter-provincial river.

The law governing water rights in the Provinces of Manitoba, Saskatchewan and Alberta is the Common Law doctrine of riparian rights.⁵ In 1930 and 1931, following the transfer of the natural resources to the Prairie Provinces, each of these provinces enacted legislation on water rights, as follows:

Manitoba: The Water Rights Act (1940 Revised Statutes of Manitoba, cap. 230).

Saskatchewan: The Water Rights Act (1940 Revised Statutes of Saskatchewan, cap. 41).

Alberta: The Water Resources Act (1942 Revised Statutes of Alberta, cap. 65).

The basic rights of riparian proprietors are protected by each of these Acts. Section 6 (3) of the Manitoba Act reads as follows:

"Nothing contained in this Act or the regulations shall interfere with or be understood as intended to interfere with the right of any person owning or occupying any land which adjoins any river, stream, lake or other body of water referred to in this section to use such quantity of its waters as he may require for domestic or industrial purposes on the land but he shall not be entitled to the right of impounding or diverting nor shall he impound or divert from any such body of water by any dam, pipe, flume, channel, ditch, or other means used in the impounding or diversion of water any water he may require unless authority therefor has been obtained under the provisions of this Act."

Section 7 (2) of the Saskatchewan Act and section 5 (3) of the Alberta Act contain the same provision with the exception that the protection of the riparian right is restricted to the use of water for domestic purposes.

⁵ e.g., *Groat v. City of Edmonton*, 1928 S.C.R. 522.

"Domestic purposes" is defined in the same way in each of the Acts as including household and sanitary purposes and all purposes connected with the watering of stock and the working of agricultural machinery.

"Industrial purposes" is also defined in each of the Acts in substantially the same way as meaning the operation of railways and factories.

Appropriation of water rights otherwise than under the provisions of the statutes is prohibited by each of the Acts. Section 8 of the Alberta Act and section 11 of the Saskatchewan Act are the same as section 8 of the Manitoba Act, which reads as follows:

"Unless acquired by a grant made in pursuance of some agreement or undertaking existing at the time of the coming into force of this Act, no right to the permanent diversion or to the exclusive use of the water in any river, stream, watercourse, lake, creek, spring, ravine, canyon, lagoon, swamp, marsh, or other body of water shall be acquired by any riparian owner or any other person by length of use or otherwise than as it may be acquired or conferred under the provisions of this Act or the regulations."

Each of the Acts protects existing licensed rights to water granted prior to the coming into force of the Act and provides for the acquisition of rights in water which is the property of the Crown for various purposes and for the construction of necessary works therefor, upon application made under the Act. Such applications have precedence in the following order:

Manitoba: (1) domestic purposes; (2) municipal purposes; (3) industrial purposes; (4) irrigation purposes; (5) other purposes.

Saskatchewan: (1) domestic purposes; (2) municipal purposes; (3) industrial

purposes; (4) irrigation purposes; (5) other like purposes; (6) mineral water purposes; (7) mineral recovery purposes.

Alberta: (1) domestic purposes; (2) municipal purposes; (3) industrial purposes; (4) irrigation purposes; (5) water power; (6) other purposes.

While in Manitoba and in Alberta applications for water rights have precedence according to the respective dates of their filing, an amendment to the Saskatchewan Act in 1951 provides that precedence of application does not entitle the applicant to a prior right to water.

Section 11 of the Manitoba Act further protects the rights of riparian proprietors, as follows:

"No application for any purpose shall be granted where the proposed use of the water would deprive any person owning lands adjoining the river, stream, lake or other source of supply of whatever water he requires for domestic and industrial purposes."

Section 15 of the Saskatchewan Act contains a similar provision but only with respect to water required for domestic purposes.

The Common Law rights of the riparian proprietor were set out in the leading case of *Miner v. Gilmour* (12 Moore's P.C. Reports 131) as follows:

"By the general law applicable to running streams, every riparian proprietor has a right to what may be called the ordinary use of the water flowing past his land; for instance, to the reasonable use of the water for his domestic purposes and for his cattle, and this without regard to the effect which such use may have, in case of a deficiency, upon proprietors lower down the stream. But, further, he has a right to the use of it for any purpose, or what may be deemed the extra-

ordinary use of it, provided that he does not thereby interfere with the rights of other proprietors, either above or below him. Subject to this condition, he may dam up the stream for the purpose of a mill, or divert the water for the purpose of irrigation. But, he has no right to interrupt the regular flow of the stream, if he thereby interferes with the lawful use of the water by other proprietors, and inflicts upon them a sensible injury."

The legislation governing water rights in each of the Prairie Provinces asserts and preserves the Common Law right of the riparian proprietor to the ordinary use of the water flowing past his land, that is, its use for domestic purposes and for his cattle (and in Manitoba for industrial purposes) but restricts such "extraordinary use" of it as the right to impound or divert water, unless he has received authority therefor under provincial statutes.

If a rule, such as that laid down by the United States Supreme Court,⁶ that it is not unreasonable to enforce against a State its own local law governing water rights, is applied, it is submitted that the respective legal rights of the Provinces of Manitoba, Saskatchewan and Alberta in the surface waters of interprovincial rivers are the Common Law rights of riparian proprietors, in so far as these provinces are riparian proprietors.

"The law relating to the rights of riparian proprietors," said Lord Macnaghten, in *Young & Co. v. Bankier Distillery Co.*,⁷ "is well settled. A riparian proprietor is entitled to have the water of the stream, on the banks of which his property lies, flow down as it has been accustomed to flow down to his property, subject to the ordinary use of the flowing water by upper proprietors, and to such further use, if any, on their part in connection with their property as may be reasonable under

the circumstances. Every riparian proprietor is thus entitled to the water of his stream, in its natural flow, without sensible diminution or increase and without sensible alteration in its character or quality. Any invasion of this right causing actual damage or calculated to form a claim which may ripen into an adverse right entitles the party injured to the intervention of the Court."⁸

If the rule, as set out above, is applicable, it is submitted that each of the Provinces of Manitoba, Saskatchewan and Alberta has legal rights to the reasonable use of the surface waters of the Saskatchewan River system, which rights must be respected; that none of these provinces may dispose of such waters within its boundaries to the injury or prejudice of one or both of the other provinces; and, that a major diversion of such waters in one province which has the effect of diminishing the quantity or affecting the quality of the flow into another province may injuriously affect the rights of the latter province.

It does not follow that every diversion of water would be wrongful. The right to flowing water is a right incident to property in the land entitling each proprietor to a just and reasonable use of such water as it passes through his land. It has been pointed out that:

"What is such a just and reasonable use, may often be a difficult question, depending on various circumstances. To take a quantity of water from a large running stream for agriculture or manufacturing purposes, would cause no sensible or practicable diminution of the benefit, to the prejudice of a lower proprietor; whereas, taking the same quantity from a small running brook passing through many farms, would be of great and manifest injury to those below, who need it for domestic supply or watering cattle; and therefore it would be an unreasonable use of the water,

⁶ *Kansas v. Colorado*, 206 U.S. 46

⁷ 1893 A.C. 691, 698.

⁸ Per Lord Sumner in *Stollmeyer v. Trinidad Petroleum Co.*, 1918 A.C. 485, 491.

and an action would lie in the latter case and not in the former. It is therefore, to a considerable extent a question of degree . . ."⁹

The natural rights of a riparian proprietor being rights incidental to the ownership of property are not primarily rights of user.¹⁰

"All persons having lands on the margin of a flowing stream, have, by nature, certain rights to use the water of that stream, whether they exercise those rights or not; and they may begin to exercise them when they will."¹¹

It follows that under the strict riparian doctrine, the owner of riparian rights who makes no use of the water may, nevertheless, enjoin interference with those rights by other proprietors. In the leading English case of *Mason v. Hill*,¹² Lord Denman said:

"The proposition of the defendant is that the right to flowing water is *publici juris*, and that the first person who can get possession of the stream and apply it to a useful purpose, has a good title to it against all the world, *including* the proprietor of the land below, who has no right of action against him unless such proprietor has already applied the stream to some useful purpose also, with which the diversion interferes; and in default of his having done so, may altogether deprive him of the benefit of the water. The position that the first occupant of running water for a beneficial purpose has a good title to it, is perfectly true in this sense, that neither the owner of the land below can pen back the water, nor the owner of the land above divert it to his prejudice . . . But it is a very different question whether he can take away from the owner of the land below, one of its natural advantages, which is capable of being applied to profitable purposes, and generally increases the fertility of the soil even when unapplied, and deprive him of it altogether by anticipating him in its application to

a useful purpose. If this be so, a considerable part of the value of an estate, which, in manufacturing districts particularly, is much enhanced by the existence of an unappropriated stream of water with a fall, within its limits, might at any time be taken away . . ."

The rule that the first occupant of running water who appropriates such water for a useful purpose does not by the mere fact of such prior appropriation acquire a right to a permanent diversion or to the exclusive use of the water, is embodied in the water rights legislation of each of the Prairie Provinces.¹³ The fact that a lower proprietor may have made no beneficial use of his riparian rights does not affect the case. If the rule is applied to the provinces, it follows, for example, that if Manitoba has not as yet applied to a useful purpose its rights in the surface waters of the lower reaches of the Saskatchewan River system, it has not thereby forfeited such rights in favour of one or both of the other provinces which may have made beneficial use of the waters within their boundaries.

While it has been submitted that if rules, such as those applied by the United States Supreme Court in controversies between States arising from the use of interstate waters, are applied to similar controversies between the three Prairie Provinces, each province, to the extent that it is a riparian proprietor, may assert riparian rights in interprovincial waters, it is essential to note that in asserting such rights a State is constitutionally in a different position from a

⁹ Shaw, C. J., in *Elliott v. Fitchburg Railroad Co.*, 10 Cush. 191, 193, 196.

¹⁰ Cotton, L. J., in *Kensit v. Great Eastern Railway Co.*, 27 CL.D. 122.

¹¹ *Sampson v. Hoddinot*, (1857) 1 C.B. (N.S.) 590.

¹² (1833) 5 B. & A.L.

¹³ Water Rights Act (Man.) sec. 8; Water Rights Act (Sask.) sec. 11; Water Resources Act (Alta.) sec. 8.

Canadian province. The United States Constitution (Art. III, sec. 2) extends the judicial power of the United States "to Controversies between two or more States" and confers original jurisdiction upon the Supreme Court in all cases in which a State is a party. There is no corresponding provision in the British North America Act for the adjudication of controversies between provinces. Parliament has, therefore, provided for such adjudication but with due regard to the constitutional position of the provinces. The Exchequer Court Act (1927 R.S.C., cap. 34, sec. 31) provides as follows:

"When the legislature of any province of Canada has passed an Act agreeing that the Exchequer Court shall have jurisdiction in cases of controversies,

(a) between the Dominion of Canada and such province;

(b) between such province and any other province or provinces which have passed a like Act;

the Exchequer Court shall have jurisdiction to determine such controversies.

2. An appeal shall lie in such cases from the Exchequer Court to the Supreme Court."

In the case of the Province of Ontario v. the Dominion of Canada (42 S.C.R. at pp. 118-119), Mr. Justice Duff, of the Supreme Court, said, with respect to this provision:

"The 'Exchequer Court Act' confers upon that court jurisdiction to decide a controversy such as this. It says nothing about the rule to be applied in reaching a decision; but it is not to be supposed that (acting as a court) that court is to proceed only upon such views as the judge of the court may have concerning what (in the circumstances presented to him) it would be fair and just and proper that one or the other party to the controversy should do. I think that in providing for the determination of controversies the Act speaks of controversies about rights; pre-supposing some rule or principle according to which such rights can be ascertained; which rule or principle

could, it should seem, be no other than the appropriate rule or principle of law. I think we should not presume that the Exchequer Court has been authorized to make a rule of law for the purpose of determining such a dispute; or to apply to such a controversy a rule or principle prevailing in one locality when, according to accepted principles, it should be determined upon the law of another locality. This view of the functions of the court under the Act does not so circumscribe those functions as greatly to restrict the beneficial operation of the statute. Whatever the right of the Dominion in such a case as the present it is difficult to see how the province could (apart from the statute and without its consent given in the particular case) be brought before any court to answer the Dominion's claim. The statute referred to and the correlative statute of the province once for all give a legal sanction to such proceedings, and provide a tribunal (where none existed) by which, at the instance of either of them, their reciprocal rights and obligations touching any dispute may be ascertained and authoritatively declared."

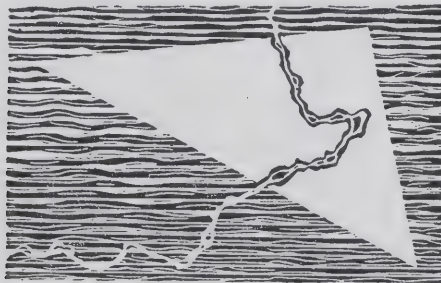
Accordingly, a controversy between two or more provinces affecting rights, such as rights in interprovincial waters, may be adjudicated on the basis of the appropriate principles of law; but only with the consent of each of the provinces concerned expressed by an Act of its legislature. Without its consent so expressed, a province cannot be brought before the courts to answer the claim of another province. Failing adjudication by the courts, the provinces must have recourse to an interprovincial agreement for the protection of their respective rights. It has been pointed out that with respect to the rights of States in interstate waters, the Supreme Court of the United States has expressed a preference for the apportionment of such waters by interstate compacts rather than by judicial determination.

In the light of the foregoing, it is important to note the 1948 agreement setting up

the Prairie Provinces Water Board, already referred to, under which the three provinces, recognizing their respective rights in inter-provincial waters, departed from a strict application of the doctrine of riparian rights by accepting the principle of allocation of such waters in accordance with the most beneficial use thereof "in relation to associated resources in Manitoba, Saskatchewan and Alberta". Riparian rights, as has been pointed out, may be asserted without regard to beneficial use and even if the water cannot apparently be applied to a useful purpose. In effect, therefore, the 1948 agreement set out the principle of equitable apportionment of the waters on the basis of their most beneficial use in relation to the resources of the provinces.

Notwithstanding the principle underlying the agreement, differences have arisen between the provinces as to the proper basis for determining allocations of water in the river system of which the South Saskatche-

wan forms a part. It is argued, on the one hand, that allocations should be governed only by the available supply of water, and, on the other hand, that regard must be had not only to the available supply but also to its most beneficial use. It is clear that if available supply alone is taken into account, most beneficial use in the wider sense may have to give way to beneficial use in a more local sense. Considering the rights of each of the Prairie Provinces in the inter-provincial waters and the importance attached to financial participation by the Government of Canada in the development of these waters, it is submitted that major allocations of water must have regard to the requirements of a reasonably integrated development of the entire system. Such development cannot be contemplated without agreement by the three provinces to subordinate their rights to the principle of the most beneficial use of the waters properly determined.



The South Saskatchewan River Project

THE South Saskatchewan River Project proposes to utilize the water of the South Saskatchewan River and its tributaries, to irrigate lands in Central Saskatchewan.

By means of a dam constructed at a site near Outlook, Saskatchewan, 80 miles upstream from the City of Saskatoon, it is possible to create a reservoir 140 miles long. This reservoir will be adequate to irrigate nearly a half a million acres of land and as well provide the source for generating electrical energy for domestic, irrigation and industrial uses. In addition, the reservoir will permit the diversion of water down the Qu'Appelle Valley, provide a source of water supply for the cities of Moose Jaw and Regina, and regulate the river flows below the damsite.

The project will require the construction of:

1. An earth dam on the South Saskatchewan River, 205 feet high and 8,500 feet long;
2. An auxiliary earth dam in the Qu'Appelle Valley to prevent the impounded waters from escaping down the valley;
3. A spillway channel, about three miles long, with a concrete control structure;

4. A reinforced concrete outlet works through the dam to provide for river diversion, the generation of power, and river regulation;
5. A powerhouse with an installed capacity of 150,000 horsepower, for generating power;
6. Five hundred miles of main canals and laterals, and 12 pumping stations to transport water to the lands to be irrigated;
7. A high level railway crossing of the Qu'Appelle Valley to provide for C.N.R. and C.P.R. rail transportation in that vicinity.

The following section will describe the main engineering features of the Project, as far as they have been defined by the engineering services of the P.F.R.A. Then it will set out the main agronomic aspects of the Project, as they have been analyzed in reports prepared for the P.F.R.A.

General Engineering Features

Selection of Site: The first location to be investigated for the proposed diversion from the South Saskatchewan River was in the reach of river between Saskatchewan Landing, north of Swift Current, and the Cabri Ferry, about 20 miles upstream. The purpose of this general location was to utilize

a depression in the north bank, known as the White Bear Depression, through which to convey water to most of the lands originally included in the North Saskatchewan project investigated by the Department of Reclamation and lying generally between Elrose and Rosetown on the west, and Outlook and Saskatoon on the east.

Six profiles were surveyed and drilled. This brought out the following facts:

- (a) The dam required would have been between 110 and 150 feet high and it would have had provisions for some power.
- (b) The project was feasible from a topographic point of view.
- (c) The foundations were not as good as had been hoped for, and materials for construction were inferior.
- (d) The reservoir would have flooded a large area of valuable lands in the vicinity of Lacadena, Saskatchewan.
- (e) The reservoir capacity would not have been large enough to make best use of the flow of the river.
- (f) Agricultural and soils reports on the lands which would have been served from this location, reduced the area suited to irrigation to a small fraction of the acreage originally estimated.

It was found that there was a large area of excellent irrigable land to the east of the Saskatchewan River and in the Qu'Appelle River Valley. However, the Qu'Appelle area could not be reached with water from this point of diversion, and the area east of the river could be reached only by means of an expensive syphon crossing of the South Saskatchewan River. At the same time, an urgent need for domestic water had developed in the Qu'Appelle Valley.

Attention was therefore directed to the reach of river between Elbow and Outlook. Three general sites were explored in this reach—one just above the junction with the Qu'Appelle Valley, another close to the town of Outlook called Site 8, and another at Coteau Creek called Site 10. The site above the Qu'Appelle Valley junction would serve most of the objectives aimed at, and would avoid the railway damages associated with any site downstream. However, foundations proved the poorest yet investigated and further consideration was dropped. Of the remaining two sites, careful investigation showed Site 10 at Coteau Creek to be superior. The advantages of this site are:

1. The possible reservoir capacity which can be developed by a dam in this reach is the greatest on the river, because of the huge side-channel volume in the Qu'Appelle Valley.
2. This reservoir site is close to the irrigable area on both sides of the river.
3. A reservoir in this section will permit casual diversion of water down the Qu'Appelle Valley as required for irrigation and domestic uses.
4. Because of Qu'Appelle Valley storage, the reservoir is more efficient for power than any upstream site.
5. The side-channel storage in the Qu'Appelle cannot accumulate silt from bed load or suspended load movement in the main river.
6. Suitable earth materials of the classes required for construction are found in abundance on both banks.
7. All the required gravel for concrete aggregates is available on the site.

Main Dam.—The proposed South Saskatchewan dam, spillway and appurtenant

works are located adjacent to the North boundary of Township 26, Range 7, west of the Third Meridian, about 15.5 miles downstream from the Elbow.

The dam will be a rolled earth fill 205 feet high with a crest length of 8500 feet, and a crest at elevation 1845. The crest width will be 60 feet and the maximum base width in the River channel will be 2600 feet, exclusive of a 1200-foot upstream blanket. Embankment slopes will vary from 2 to 1 at the top to 8 to 1 at the bottom. A roadway will be constructed across the crest and tentative plans make provisions for carrying a railway across the dam. The upstream and downstream portions of the dam will consist of pervious fill material; the core will be impervious rolled earth fill. The upper 40 feet of the upstream slope will be protected by riprap.

The area under the dam is underlain by Bearpaw shale. The shale in turn is underlain by Belly River sandstone. The overburden consists principally of sand in the river bed, with clay, sand and gravel in the abutments. To prevent seepage under the dam through the overburden, a 1200-foot blanket varying in thickness from 34 to 10 feet will be constructed in the river bed, and a cutoff trench will be excavated to the Bearpaw shale under the abutments.

A detailed sub-surface exploration has proven that ample quantities of material suitable for the rolled earth-fill and pervious zones of the dam are available in the immediate vicinity. This material has a good distribution on both sides of the river and sufficient impervious and pervious fill can be obtained within easy haul distance. Riprap surveys have been made which indicate

that all the material required for riprap and closure rock could be obtained within 40 miles of the site.

Spillway.—A gated, reinforced concrete chute spillway will be located southwest of the main fill about a mile away from the west abutment. This location utilizes a natural depression to reduce the approach channel excavation. The over-all length is 17,000 feet, of which 8,000 feet is approach channel, 3,000 feet is reinforced concrete control structure and 6,000 feet is exit channel.

The drainage area of the South Saskatchewan River above the proposed damsite is 48,800 square miles. The spillway is designed to pass a flood with a peak discharge of 400,000 c.f.s., a total volume of 4,000,000 acre-feet in 16 days. This design flood when routed through the spillway, indicated a maximum spillway discharge of 265,000 c.f.s. with the reservoir rising to elevation 1830, five feet above full supply level. The largest flood on the river during the period of record was 131,000 c.f.s. in June, 1923.

The approach channel is 600 feet wide with 3 to 1 side slopes and a bed elevation of 1775. A pilot channel 100 feet wide with 3 to 1 side slopes at elevation 1650 will be excavated for the exit from the stilling basin. The crest of the concrete chute is 520 feet wide and its elevation is 1797.5. There are eleven 40-gate openings with ten eight-foot thick concrete piers to support roadway and railroad bridges. The chute section is tapered from a 520-foot width at the crest to a 400-foot width about 600 feet below the crest, this section being continued to the stilling basin. The stilling basin is the same width as the chute and 300 feet long at elevation 1608. The control gates selected

for the spillway are 40 x 29 metal tainter gates. This size has been standardized by the U.S. Corps of Engineers.

The spillway will be founded on materials varying from pervious sands and gravels to impervious clays and shales. No difficulty is expected in placing the spillway on sand, gravel and clays but special precautions must be taken where the structure will be on or close to the shale formation. Where the structure is located on shale it will be designed so that the weight of the structure will balance the weight of the material excavated wherever this is practical, in order to eliminate the upward heave due to elastic rebound and swelling of the shale. The spillway will be constructed on a schedule which will allow differential settlements due to uneven reloading of the foundation to take place before the structure is complete.

Outlet Works.—A multi-barrelled conduit of reinforced concrete 2750 feet long with four 25-foot diameter barrels has been tentatively selected for diversion purposes. This conduit must be able to pass the design diversion flow without excessive head under initial closure conditions, and must in addition be capable at a later date of passing the maximum probable June flow during the construction period.

The conduit will be used as a reservoir outlet works after completion of the dam. Twenty-foot diameter penstocks will be installed in three of the conduit barrels to supply water to the powerhouse, and the fourth barrel will provide for river regulation.

The conduit as presently proposed will be located in the west abutment. This location was chosen because it provided a suitable bench where foundation conditions were uniform and there was no indication of any

movement having occurred. This also eliminates the necessity for any deep cuts in the shale at the inlet, outlet and powerhouse areas. The slopes adjacent to these structures are very gradual and therefore will be stable under any conditions to which they might be subjected.

The conduit in cross-section will be a reinforced concrete block 152 feet wide and 45 feet high with four 25-foot diameter openings through it. Wall thicknesses are 10 feet between barrels and eight feet outside. A tapered section of low strength unreinforced concrete will be placed adjacent to the sides of the block for most of their length. This will permit a gradual change of fill height from the depth of fill over the conduit to the depth of fill beside the conduit, with a view to obtaining a gradual transition in differential settlements. These sections will also reduce any draping effect which would tend to increase the vertical load on the conduits proper.

The control tower will be located near the upstream end of the conduit, about 700 feet from the dam centreline. This tentative location has resulted from a compromise between keeping it as near the inlet as possible and minimizing the length of an access bridge to the dam crest. The tower will be 50 feet by 152 feet, and will rise 210 feet above the conduits. Tentative plans are to provide two tractor-type gates for each conduit opening, 10 feet wide and 25 feet high for both emergency and operating sections.

During the preliminary planning of the project, the possibility of using tunnels at various sites was considered. In order to restrict the tunnels to an economical length, deep approach and exit channels cut into

the shale abutment would have been necessary. Although deep cuts in shale may pose a difficult stability problem during both construction of the dam and operation of the reservoir, the possibility of using tunnels for diversion is still being considered. At present the relative merits of tunnels and conduits are still being studied and the final decision as to which will be adopted will depend on the relative safety and economy of the alternatives.

Reservoir.—The reservoir created by the construction of the dam will impound 8,400,000 acre-feet of water, of which about 2,650,000 acre-feet will be live storage for irrigation purposes, between full supply levels in reservoir and irrigation canals, and a total of about 4,000,000 acre-feet for river regulation. This reservoir will extend from Saskatchewan Landing to the Coteau dam-site, and 30 miles down the Qu'Appelle Valley, at which point a secondary dam will be located. The flooded area at full supply level will be 116,000 acres of land, 11 per cent of which is under cultivation; the remainder is land immediately adjacent to the river which has little agricultural value.

Flooding of the Qu'Appelle Valley will make it necessary to raise or relocate a portion of the C.P.R. line from Moose Jaw to Outlook. The C.N.R. line from Central Butte to Dunblane will have to be relocated as both the portion in the Qu'Appelle Valley and the bridge crossing on the South Saskatchewan River will be flooded by the reservoir.

Qu'Appelle Valley Dam.—In selecting the locations for a dam across the Qu'Appelle Valley, many economic factors must be considered aside from topographic and founda-

tion conditions. In all, five sites have been explored as possible embankment location. These sites are known as the Elbow Crossing site, C.P.R. Crossing site, Summit site, Ridge Creek site and the Third Meridian site.

The most important factor in selecting a site, other than topographic and foundation conditions, is that the further east the dam is constructed, the greater the reservoir capacity of the project will be. However, there is a limit to how far east the dam can be placed as beyond the Third Meridian the Qu'Appelle Valley widens appreciably, and also the height of dam increases rapidly. Another factor to be considered is the problem of providing railway crossings for the C.P.R. and C.N.R. lines which will be flooded in the Qu'Appelle area.

In order to provide the extra storage which will be available in the Qu'Appelle Valley, it is proposed to construct the embankment at the Third Meridian site, which is considered to be as far east as is practicable. This embankment will be 4300 feet long and 130 feet high. Preliminary drilling has indicated an abundance of suitable borrow material available at the site, as well as an adequate source of pervious and semi-pervious material. Surveys by aerial photographs indicate the presence of an adequate supply of riprap on adjacent valley slopes.

A second embankment will be constructed at the Elbow Crossing site for railroad relocation purposes. The embankment will be 6700 feet long and 135 feet high. Provision will be made for conduits through the embankment of a capacity, such that the depth of water will remain very nearly the same on both sides of the fill. Foundation conditions appear favourable at the site of the proposed embankment. Both abutments and the valley

bottom are composed of glacial till overlying the bedrock material, Bearpaw shale. The limited amount of drilling to date in search of borrow materials indicates there are ample quantities of first class pervious and impervious materials present for construction purposes. Aerial photograph studies indicate an ample supply of riprap on the valley slopes adjacent to the site.

Hydrology.—The South Saskatchewan River receives most of its water from eight major tributaries, which rise on the eastern slope of the Rocky Mountains in the Province of Alberta and the State of Montana. This river actually starts where the Oldman River with its tributaries, the St. Mary, Belly and Waterton, and the Bow River, with its tributaries, the Highwood and Elbow flow together, midway between the cities of Lethbridge and Medicine Hat in southern Alberta. The Red Deer River joins the main stream at the Alberta-Saskatchewan boundary, near Empress. The river flows from the boundary, in an easterly direction, through southern Saskatchewan to Elbow, then northerly through the City of Saskatoon, to the junction with the North Saskatchewan River, 30 miles east of the City of Prince Albert.

The drainage area of the river contains about 65,500 square miles. The portion of this area upstream from the proposed dam-site contains 48,800 square miles.

Flow in the South Saskatchewan River is subject to a wide seasonal variation. Base flow is derived from ground water and melting glacial ice. The snow-melt in the foothills and on the prairies usually causes an early spring flood, and larger floods occur in June, when run-off from snow-melt in the

mountains is supplemented by heavy spring rainfall. Continuous heavy rainfall during September and October has caused appreciable rises in the normally low fall flow. The flow in the river is subject to some regulation by power and irrigation works on tributaries in Alberta, and although this effect is negligible during the flood season, the diversions for irrigation appreciably reduce the total annual discharge.

Diversion of water for irrigation and urban water supply, and storage for power, has varied considerably during the period for which hydrometric records on the South Saskatchewan River are available. To get a picture of the water available for the South Saskatchewan River project, it is necessary to assemble complete data on recorded flows, and then reconstruct the natural flows, by taking into account the historical upstream uses of water. By allowing for the water requirements of all the existing and planned projects upstream, it is possible to obtain an estimate of the water available for the project in the future.

Fairly complete hydrometric records for the South Saskatchewan River have been kept at Medicine Hat and Saskatoon since 1911. The average annual recorded flow at Saskatoon for the period 1911-1948 was 7,128,000 acre-feet, varying from a maximum of 14,610,259 acre-feet in 1915-1916 to a minimum of 3,440,000 acre-feet in 1940-1941.

Water from the watershed has been used in the past by Saskatchewan, Alberta and United States irrigationists. In order to determine the net water diversion by

historical users, it is necessary to study the operation of the following projects:

*Milk River Project	United States
St. Mary-Milk River Project	Alberta
Leavitt Irrigation District	Alberta
Mountain View Irrigation District	Alberta
United Irrigation District	Alberta
Lethbridge Northern Irrigation District	Alberta
Canada Land and Irrigation Company	Alberta
Eastern Irrigation District	Alberta
Western Irrigation District	Alberta
Swift Current Irrigation District	Saskatchewan
City of Calgary Water Supply	Alberta

The existing and planned irrigation projects with acreages to be irrigated are tabulated in Table I. All of these projects are in Alberta with the exception of the Swift Current Irrigation Project, which is in Saskatchewan.

TABLE I

Project	Acreage Area Under Irrigation 1952	Ultimate Irrigated Acreage Allowed for
Western Irrigation District.....	50,000	50,000
Eastern Irrigation District.....	200,000	281,000
Bow River (Canada Land) and Irrigation Co.....	50,000	240,000
Lethbridge Northern Irrigation District.....	75,000	96,135
United Irrigation District.....	21,000	34,000
Mountain View Irrigation District...	3,600	3,600
Leavitt Irrigation District.....	2,500	4,400
Aetna Irrigation District.....	50	7,300
St. Mary-Milk River River Project..	150,000	495,000
Red Deer Project.....	Planned only	350,000
Macleod Irrigation District.....	500	5,000
Small Projects(1).....	Planned only	64,000
Swift Current Irrigation Project.....	7,500	21,000
Private projects.....	50,000	70,000
	610,150	1,721,400

(1) Possible small projects are:

	acres
Carmangay.....	12,000
Macleod Extension.....	20,000
Pincher Creek.....	16,000
Oldman projects.....	16,000
	64,000

Estimates of the future upstream requirements of these projects have been based on the assumption of an eighteen-inch duty of water and an 80 per cent irrigation factor, with varying allowances for conveyance losses and return flows. It has also been assumed that the Clearwater River, tributary of the North Saskatchewan River, will be diverted into the South Saskatchewan watershed to help irrigate the Red Deer Project. No allowance need be made for the 15,000 acres that will be irrigated on the St. Mary-Milk River Project from the Milk River.

Hydro-electric power developments in the watershed are limited to those in operation on the Bow River by the Calgary Power Ltd. The regulation of flow from its storage reservoirs of 536,000 acre-feet is taken into account.

TABLE II

Average Annual Flow of South Saskatchewan River (1911-48) Ac. ft.

Type of Flow	U.S. Water*	At Alberta- Saskatchewan Boundary	At Saskatoon	At Damsite
Recorded.....	Included	6,947,000	7,128,000	7,115,000
Historical				
Canadian Use.....		616,000	618,000	618,000
Natural.....	Excluded	7,427,000	7,610,000	7,597,000
Future				
Canadian Use.....		2,140,000	2,180,000	2,165,000
Available.....	Excluded	5,287,000	5,430,000	5,432,000

* Unused portion of United States share of the flow of St. Mary River.

The water available to the South Saskatchewan River Project is tabulated in Table II. This water study indicates that the

*By order of the International Joint Commission in 1921, the United States has the right to use a certain portion of the St. Mary River.

average annual flow available at the damsite, based on records from 1911-1948, is 5,432,000 acre-feet. Some consideration should be given to the fact that upstream projects will not be developed to the extent allowed for in these studies for several years, and in the interim, all the additional water would be available for the production of additional commercial energy at this Project.

Water Utilization

The reservoir created by a dam on the South Saskatchewan River, will provide live storage for 4,000,000 acre-feet of water, enough to allow beneficial use of all the flow in the river, during all but the very high flow years. Creating a reservoir of this size in the prairie region would provide a source of water which could remedy many of the water deficiencies in the immediate area.

1. *Irrigation*.—The primary purpose of the project is irrigation. It is estimated that

455,000 acres of land can be irrigated by water from the South Saskatchewan Reservoir. Several compact blocks, which are spread out from Saskatoon to Elbow in the north and south direction, and from Colonsay to Asquith in an east and west direction, make up 431,000 acres of this area. In addition, some small parcels of land, 24,000 acres in all, can be irrigated along the Qu'Appelle Valley.

Topographical surveys have not been completed to the stage where all the irrigation works can be designed. Sufficient information is available, however, to make a preliminary layout of these works.

All of the irrigable lands cannot be reached by gravity canals. It is planned, by the use of hydro-electric energy generated at the damsite, to pump water from the reservoir to irrigate lands which lie as much as 120 feet above the gravity canals. A summary of the gravity areas, and those requiring pump irrigation, is given in Table III.

TABLE III
South Saskatchewan River Project

Area	Static Lift ft	Area to be Irrigated acres	Main Canal			Pumping Plants		
			Section	Capacity cfs	Length miles	Pump No.	Capacity cfs	Lift ft
1	0	69,300	Canal 1					
			Main	2,909	3.9			
			Sec A	1,360	16.2			
			Sec B	1,050	21.9			
			Sec C	230	10.5			
2	0	15,300	Sec D	200	6.0			
			Canal 2					
			Main	2,137	16.8			
			Sec A	1,711	16.2			
3	0	11,900	Sec B	1,371	7.5			
			Canal 3					
			Sec A	1,326	4.3			
			Sec B	132	6.7			

TABLE III—Con.
South Saskatchewan River Project

Area	Static Lift ft	Area to be Irrigated acres	Main Canal			Pumping Plants		
			Section	Capacity cfs	Length miles	Pump No.	Capacity cfs	Lift ft
4	0	28,800	Canal 4	793	16.2			
5	0	22,500	Canal 5	404	18.0			
6 and 11	15 and 30	24,100	Qu'Appelle River					
7	15	18,750	Canal 7	343	15.6	XI	340	15
8	15	7,000	Canal 8	335	10.8			
8(a)	10	2,100	Sec A	57	3.9	IV	100	10
			Sec B	100	2.7	VI	57	15
9	0	11,900	Canal 9	245	19.5			
10	18	5,000	Canal 10					
10(a)	0	10,000	Sec A	315	11.7			
			Sec B	200	8.4			
			Sec C	110	8.4	V	100	18
12	39	39,600	Canal 12					
			Sec A	1,550	8.1	I	1,550	39
			Sec B	600	24.6			
13	30	11,700	Canal 13	230	12.0	X	250	30
14	0	10,000	Canal 10					
14(a)	15	8,000	Sec A	1,131	1.3			
			Sec B	1,006	7.2			
			Sec C	156	3.3	VIII	150	15
15	73	34,200	Canal 15					
			Sec A	130	9			
			Sec B	1,050	9.6	II	1,150	34
			Sec C	430	39			
16	60	19,600	Canal 16	354	14.6	VII	350	60
17	60	26,600	Canal 17	466	18.9	IX	450	60
18	123	33,700	Canal 18	640	45	III	650	50
19	120	10,800	Canal 19	232	14	XII	575	120
20	120	23,100	Canal 20	439	18	XII	575	120
21	120	11,000	Canal 21	232	21.6	VII	200	120
Totals: Gravity			30' lift	70,400	120' lift	78,600		
15' lift			60' lift	80,400		455,000		

To supply water to all of the area it will be necessary to construct nearly 500 miles of canals and main ditches, and 12 pumping stations. The capacity of these canals will vary from 2900 cubic feet per second at the reservoir, to 100 cubic feet per second near the end of the system. Pumping plants will be required with capacities varying from 1550 cubic feet per second on the larger canals, to 100 cubic feet per second on the smaller lateral ditches.

A soil survey, covering 1,328,800 acres of this general region, has been completed. The soils were classified as to their suitability for irrigation in five soil classes. These were designated as "very good soils", "good soils", "fair soils", "poor (doubtful) soils", and "very poor (unsuitable) soils". The lands included in the irrigation plans have been selected from the first three soil grades. However, class four soil will be irrigated in some cases because of its proximity to the distribution ditches.

The development of the irrigation system could be carried on at any rate which seems desirable and practical. No water could be made available for irrigation until the dam has been practically completed. Therefore, it would not be necessary to start work on the irrigation system until three or four years before the scheduled completion of the dam. A reasonable program would plan to be ready to serve all the gravity lands by the time the dam was completed.

2. Maintenance of Lake Levels.—The development will permit diversion of the water down the Qu'Appelle Valley, and in addition to providing a water supply for irrigation there it can be used to maintain water levels in Long Lake and the six Qu'Appelle

Valley lakes. This valley has been developed extensively as a recreation and resort area to serve a large part of the population of Saskatchewan and lowering of the lake levels during successive dry years in the past has seriously deteriorated these resorts.

3. Urban Water Supply.—The Government of Canada has agreed to maintain levels in Buffalo Pound Lake for a water supply for the cities of Regina and Moose Jaw. Water for this purpose will be obtained by pumping from the South Saskatchewan River. This obligation could be met with water by gravity flow from the large reservoir, which would result in saving the annual pumping costs.

4. Power.—Details of the power development, for the purpose of this section, have been drawn from the General Engineering Report issued by the P.F.R.A., March, 1952.

A study of stream flow characteristics and the distribution of energy demands in the power grid in Saskatchewan indicates that the generating station at the Coteau damsite should have an installed capacity of about 150,000 KW. Tentative plans are to install six 24,000 KW and two 4,000 KW units, which would give a total installed capacity of 152,000 KW. Water will be carried to the turbines by three 20-foot diameter steel penstocks inside the 25-foot diameter conduit openings. Each penstock will feed water to two units through Y-branches.

The approximate over-all dimensions of the powerhouse building, allowing for clearance between units, working space, office space and storage, will be 118 feet high, 88 feet wide and 365 feet long. The powerhouse will be founded on the hard shale and the location has been chosen so that the excavation required at the desired elevation will be

such that the weight of the excavated material will balance the weight of the structure and avoid either heaving or settlement.

The pumping of the irrigation water will utilize a portion of this energy, but large amounts of commercial energy will also be available. It is estimated that 325,000,000 KWH will be produced annually, 50,000,000 KWH of which will be required for pump irrigation at full development.

The generating plant would be ideally located to fit into the power grid of Saskatchewan. It is estimated that 53 per cent of the population of the province live within a radius of 125 miles of the dam, and 69 per cent within a radius of 150 miles of the dam.

5. *River Regulation.*—The wide variation of seasonal flow of this river has made power developments without large storage facilities impractical. The reservoir will provide almost complete regulation of the river flows and will increase the power potential of those downstream power sites where storage cannot be provided at the plant.

There are five potential power sites which would benefit from this regulation. Two 75-foot head sites exist between Saskatoon and the junction of the North and South Saskatchewan Rivers, and two 120-foot and one 50-foot head plants on the Saskatchewan River below the Forks. They are

Batoche	75-foot head
Coxby	75-foot head
Fort a la Corne ..	120-foot head
Nipawin	120-foot head
Squaw	50-foot head

The Fort a la Corne site has been studied in detail by the Saskatchewan Power Corporation. With an installed capacity of

125,000 HP this plant would be capable of producing 598,400,000 kilowatt hours of energy annually. The regulation provided by the reservoir will increase the annual output by nearly 100,000,000 kilowatt hours.

Studies have not been made of the other sites mentioned. However, the potential of these sites would be increased to a degree proportionate to that indicated for the Fort a la Corne site.

The Dauphin River site and those sites located on the Nelson River would not benefit materially by this regulation because of the large storage provided by Cedar Lake, Lake Winnipegosis, Lake Manitoba, and Lake Winnipeg.

6. *Floods.*—The Pike Lake area in the vicinity of Saskatoon, and the Carrot River area near The Pas, Manitoba, have been subjected to periodic flooding in the past. Creating this large reservoir on the river would virtually eliminate the flood hazard at Pike Lake, and materially decrease the magnitude of the floods in the Carrot River area.

Pertinent Data of Dam and Reservoir

Main dam, including conduit and spillway, Coteau Creek Dam, Third Meridian Dam and Elbow Railway Crossing.

Fill (including dredge fill)	57,509,000 cu. yd.
Riprap	702,000 cu. yd.
Concrete	989,010 cu. yd.
Cement	1,497,000 bbls.
Reinforcing steel	30,535 tons
Structural steel and steel plate	22,606 tons

Hydraulic(a) *Drainage Areas (Gross)*

Stream	Gauging Station	Drainage Area
Bow.....	Bassano.....	7,610 sq. mile
Oldman.....	Lethbridge....	6,710 sq. mile
Red Deer.....	Empress.....	18,160 sq. mile
South Saskatchewan..	Medicine Hat.	20,600 sq. mile
South Saskatchewan..	Damsite.....	48,800 sq. mile

(b) *Reservoir*

—	Elevation	Total Reservoir Storage acre-ft.	Area of Reservoir acres
Maximum Water Surface.....	1,830.1	9,210,000	110,000
FSL.....	1,825.0	8,570,000	104,600
Spillway Crest.....	1,797.5	5,780,000	78,100
Maximum Drawdown	1,785.0	4,700,000	68,100

(c) *Recorded Flow at Saskatoon*

The following are the flows for the climatic year from October 1st to September 30th.

Average Annual (24 yr.).....	7,127,000 acre-ft.
Maximum year (1915-1916) ..	14,610,000 acre-ft.
Minimum year (1940-1941)...	3,440,000 acre-ft.
Maximum mean month (June, 1948).....	59,830 c.f.s.
Minimum mean month (December, 1936).....	997 c.f.s.
Maximum mean daily (June 6, 1923).....	131,000 c.f.s.

(d) *Spillway Design Flood Data*

The spillway design flood is a synthetic flood.

Peak rate, inflow to reservoir.	400,000 c.f.s.
Duration of Flood.....	16 days

Total volume of run-off.....	4,000,000 acre-ft.
Pool elevation at start of flood	1,825
Maximum pool elevation reached.....	1,830
Maximum spillway discharge.	260,000 c.f.s.

(e) *Freeboard*

Computed.....	12.5 ft.
Provided (above FSL).....	20 ft.

(f) *Outlet Works*

Size of Conduits.....	25 ft.
Number of Conduits.....	4

General Agronomic Aspects

In general the method of study of the agricultural features of the South Saskatchewan River Project has been to compare the proposed irrigated area in Saskatchewan with well established irrigated districts in Alberta. Many years of experience with irrigation agriculture in Alberta together with some knowledge of the Saskatchewan area have been drawn upon in this appraisal of the material contained in the P.F.R.A. report.

The two major irrigation developments in Alberta are in the vicinities of Brooks and Lethbridge respectively. Hence weather and crop data from these two points must be taken as applicable to the surrounding irrigated farm land. However, it should be pointed out that the immediate environs of the City of Lethbridge constitute only a fairly good irrigation area. The suitability of the area improves rapidly as one proceeds eastward from Lethbridge. The Taber district, 35 miles east, is much more successful in the production of heat-loving crops such as tomatoes, cucurbits, and corn. All authorities are agreed, and considerable experience

TABLE IV

Annual precipitation in inches at points in Alberta and Saskatchewan and in two irrigated districts of the United States.

Station	Years of Record	J	F	M	A	My	J	Jy	Au	S	O	N	D	Total
Brooks.....	(25)	·57	·50	·72	1·03	1·69	1·85	2·38	1·20	1·37	·65	·50	·60	13·06
Lethbridge.....	(42)	·62	·67	·94	1·11	2·32	2·72	1·75	1·52	1·73	·96	·75	·66	15·75
Medicine Hat.....	(49)	·72	·64	·74	·82	1·74	2·36	1·60	1·37	1·25	·71	·69	·67	13·27
Outlook.....	(34)	·64	·52	·50	·62	1·13	2·52	1·78	1·32	1·07	·65	·48	·38	11·61
Saskatoon.....	(46)	·59	·52	·57	·67	1·39	2·69	2·34	1·71	1·42	·80	·56	·47	13·69
Salt Lake City (Utah).....	(40)	1·31	1·55	2·00	1·85	1·94	·74	·57	·91	·95	1·43	1·28	1·26	15·79
Fort Collins (Colorado).....	(40)	·27	·64	1·08	2·13	2·82	1·56	1·64	1·32	1·52	1·17	·49	·56	15·20

indicates, that the Medicine Hat area will be much superior to Lethbridge district for irrigation farming. The main advantages for Medicine Hat are: (1) lower altitude, (2) less wind, (3) higher temperatures, (4) longer growing season, (5) somewhat lighter soil type.

In an appraisal of the various climatic factors, the data from Brooks, Lethbridge and Medicine Hat in Alberta, and Elbow, Outlook, and Saskatoon within the proposed irrigated area of Saskatchewan were used. Data for Elbow were not available on all climatic factors studied.

Long term weather records are available for Medicine Hat, and although extensive irrigation in the immediate district must await construction of the distributory system (the water is available from the St. Mary Dam), it was thought advisable to include weather data from Medicine Hat in this study.

Table IV shows the annual precipitation for these several points in Alberta and Saskatchewan, together with data from two irrigated areas of the United States.

TABLE V

Crop season precipitation (May to September inclusive) and percentage of total precipitation in the form of snow.

—	Crop Season Precipitation	Percentage of Annual Precipitation Provided by Snow
	in.	
Brooks.....	8·49	26
Lethbridge.....	10·04	31
Medicine Hat.....	8·32	27
Elbow.....	9·14	26
Outlook.....	7·82	31
Saskatoon.....	9·55	31

Thus Outlook has annual rainfall of 11·61 compared to 13·06, 15·75 and 13·27 for Brooks, Lethbridge and Medicine Hat respectively. Crop season rainfall shows Outlook with 7·82, Saskatoon with 9·55 and Lethbridge, Medicine Hat and Brooks with 10·04, 8·32 and 8·49 respectively.

The figures for the average evaporation from a free water surface for the period May to September are available for only two

locations, viz., Lethbridge—24·60 inches and Saskatoon—27·69 inches.

The potential evapo-transpiration according to the Thornthwaite method* for the six points is as follows:

Brooks—22·50, Medicine Hat—23·08, Lethbridge—22·18, Outlook—21·25, Elbow—21·82 and Saskatoon—21·04.

Saskatoon has more annual rainfall and more crop season rainfall but less evaporation than Outlook or Elbow. Thus from the point of view of moisture and moisture efficiency, Saskatoon would have less need for irrigation than either Outlook or Elbow.

In summary, the Outlook-Elbow district appears to be poorer dry farm area than Lethbridge. Outlook has less rainfall but also much less evapo-transpiration than Medicine Hat. The seasonal deficiencies of moisture (potential evapo-transpiration minus the rainfall) for the two points are: Outlook 12·01 and Medicine Hat 13·16. Thus Medicine Hat must be considered drier than Outlook.

Saskatoon must be considered much more favourable as to moisture conditions than Medicine Hat or Brooks, perhaps approaching Lethbridge in this respect.

The average yield of wheat (1920-48) in municipalities 345, 346, 375 and 376, which are in the proposed irrigation area near Saskatoon, varied from 11·6 bu. per acre to 13·3 bu. with an average of 12·5 bu. The six municipalities near Outlook, Nos. 283, 284, 285, 313, 314 and 315 showed an average acre yield of 11·0 bu. with variation from 10·1 to 12·1 bu.

Long term records indicate that the Lethbridge district has slightly higher yield than either Outlook or Saskatoon and that the yields in the Medicine Hat and Brooks districts are poorer than in either of the Saskatchewan districts.

Prevailing Temperatures and Frost Free Season

The prevailing temperatures and the length of the growing season exert a decided influence on the suitability of an area for irrigation development. If ample moisture is available to good soil through irrigation, then temperature and length of growing season become the limiting factors in crop production.

Table VI indicates the mean monthly temperatures during the growing season at three points in the Southern Alberta area and three in the proposed irrigated area of Saskatchewan.

TABLE VI

Mean monthly temperatures during the growing season at Lethbridge, Brooks and Medicine Hat, Alberta, and at Elbow, Outlook and Saskatoon, Saskatchewan.

Station	Apr.	May	June	July	Aug.	Sept.	Oct.
Brooks.....	42	52	61	66	64	53	43
Lethbridge.....	43	51	59	65	63	54	45
Medicine Hat..	45	55	63	69	67	56	46
Elbow.....	39	53	60	68	64	53	42
Outlook.....	38	52	60	67	64	53	40
Saskatoon.....	37	51	60	65	62	51	39

A comparison of the highest average daily maximum temperatures and the lowest aver-

* Thornthwaite, an eminent U.S. climatologist, has made use of the term "evapo-transpiration". This numerical value for any given area can be calculated from records of mean temperature, giving due consideration to latitude. Evapo-

transpiration is defined as the amount of water that would be lost from the soil to the atmosphere by evaporation and transpiration if water were continually available in optimum quantity.

age daily minimum temperatures shows Outlook to be very slightly warmer than Lethbridge but cooler than Medicine Hat during the months of May to September. Saskatoon is slightly cooler than Lethbridge in May and August, decidedly cooler in April, but warmer in June; in July the temperatures are the same. Elbow is slightly warmer than Outlook.

A comparison with the mean July temperatures of some irrigated areas in United States is interesting; Havre and Chinook, two points in the irrigated Milk River Valley of northern Montana, have mean July temperatures of 68 and 70 respectively; the comparable figure for Salt Lake City is 77 and for Fort Collins, Colorado, 69. The decidedly lower temperatures at all Canadian points is quite apparent.

Growing Season and Frost Free Period

In Dr. Currie's report (*) the length of the vegetative period at various Alberta and Saskatchewan points is set forth. The vegetative period is defined as the number of days between the average dates when the mean daily temperature rises to 42°F. in the spring and falls to 42°F. in the fall. The appropriate data for three Stations in each of the two provinces are reproduced in Table VII, also included in this table are the median lengths of the frost free period, these latter figures were obtained by calculation from Dr. Currie's report.

TABLE VII

Number of days in the vegetative period and the median frost free period at Lethbridge, Brooks and Medicine Hat in Alberta, and Elbow, Outlook, and Saskatoon in Saskatchewan.

Station	Vegetative Season	Median Frost Free Period
	days	days
Brooks.....	187	118
Lethbridge.....	189	114
Medicine Hat.....	196	125
Elbow.....	177	
Outlook.....	173	115
Saskatoon.....	163	112

The superiority of the Alberta over the Saskatchewan stations in length of vegetative season is striking. However, in median length of frost free period Elbow and Outlook are quite similar to Lethbridge and Brooks. In actual practice the length of the vegetative period is the more important criterion since many crop plants will withstand a few degrees of frost and will thus make some growth during the early spring period if the days are warm enough, even though frosts may occur occasionally at night.

Dr. Currie's report shows a calculation of the "day-degrees" which is a value related to the number of days during the year when the temperature rises above 42°F., thus inducing growth of common crop plants. The data for the three pertinent stations in each of the provinces are as follows:

Alberta		Saskatchewan	
Brooks	2655	Outlook	2595
Lethbridge ..	2590	Elbow	2660
Medicine Hat	3342	Saskatoon ...	2231

* The Climate of the South Saskatchewan Irrigation Project, B. W. Currie, Ph.D., University of Saskatchewan, 1949.

Thus Outlook and Elbow compare favourably with Lethbridge, which is a fair irrigated area. Once again the superiority of Medicine Hat is striking. Saskatoon has a decidedly lower number of heat units, even lower than Cardston in Alberta. Some small irrigation projects near Cardston have not proved to be well adapted to irrigated crop production.

Hours of Sunshine

The possible hours of sunshine during the summer months increase as the latitude increases. Thus Saskatoon has a possible total of 2313 hours of sunshine from May to September, whereas Lethbridge has a possible total of 2271. However, Lethbridge has received a long term average of 1386 hours for the period and Saskatoon has received an average of 1332. Dr. Currie has pointed out that the earlier onset of spring rains in Alberta brings about more cloud cover to this area in May and June than occurs in the Saskatchewan area.

In final summary with regard to temperature and frost free period, it would appear that the Elbow-Outlook area would be at least equally as suitable as the Lethbridge area, but inferior to the Medicine Hat district. The area around Saskatoon must be considered as somewhat inferior to the immediate environs of Lethbridge.

Soils.—The soils of the proposed irrigation area belong to the Dark Brown Soil Zone of the Province of Saskatchewan. In its native state the land supported a mixed prairie vegetation of short and medium-tall grasses. Some of the more dominant species were:

blue grama grass, spear grass, western wheat grass, pasture sage, northern wheat grass, rough fescue, sedges, rose bushes and buckbrush.

These dark brown soils are generally of high fertility and regularly produce good yields of grain when rainfall is ample.

The soil survey conducted by Moss *et al* has rated the soils as to their suitability for irrigation. This rating follows the methods outlined by Bowser and Moss.*

Texture.—The texture of the soil is generally quite satisfactory for irrigation. Less than six per cent of the total land is classified as clay. About 80 per cent of the proposed irrigated land is included in the textural classes, Fine Sandy Loam, Sandy Loam, Loam, Silt Loam, Silty Clay Loam and Clay Loam.

Topography.—A very large proportion of the proposed irrigated land exhibits nearly level, gently undulating to moderately undulating topography. There are also some areas with rolling topography but these have presently been considered unsuitable for irrigation along with sand dune areas, poorly drained depressional areas, and the cut-up lands adjacent to the streams and coulees.

Drainage.—The general area is well drained. The lands are of the upland prairie type and generally lie 200 feet or more above the level of the water in the streams. The water table of the area is generally quite deep, seldom above 20 feet. In the course of the soil survey 80 borings were made to study the permeability of the lower soil strata. A stratum of lower permeability was frequently encountered below the depth of 12 feet, although in two cases such a layer was

* A Soil Rating and Classification for Irrigation Lands in Western Canada—W. Earl Bowser and H. C. Moss. Sci. Agr. 30: 164-171, 1950.

encountered at seven feet. In the opinion of the soil surveyors, "no special difficulty should arise in the soils overlying the impervious strata". The solonetz soils generally exhibit impeded drainage and require some care in handling in order to make successful irrigated farm land.

Salt Content.—Chemical analyses indicate that a proportion of the soils have soluble salts within the upper six-foot profile. Generally these salts are below a depth of 18 inches and are not of high concentration, generally well below one per cent in the upper three feet of soil, usually entirely absent in the upper two feet.

Marshall and Palmer (*) have reported on salt movement in an irrigated solonetz soil in Alberta. After 20 years of cropping the concentration of salts was generally reduced throughout the profile and there was apparently a gradual downward movement. The soils successfully produced crops for the 20-year period discussed (1917-37) and are currently (1952) in crop production. The authors state "that no harmful effects from these salts have been observed, although the concentrations in the lower depths remain moderately high and might cause deterioration of the soil should a rise in position take place." None of the analyses quoted in the Soil Survey report of the Saskatchewan soils is as high in concentration of soluble salts as were the Alberta soils studied by Marshall and Palmer. With normal care in the application of water, alkali salts should not become a problem in the proposed irrigated area. Normal care must include discreet

location of canals and surface drainage ditches to prevent seepage and a rising water table, both of which tend to bring the alkali salts to the surface layers where they will limit crop production.

General Appraisal of Soils.—After considering soil texture, topography, alkali salt content, degree of stoniness, and degree of wind and water erosion, Moss *et al* indicate in the Soil Survey report that 25 per cent of the 450,000 acres which are suitable for irrigation is of Grade 1—very good irrigated land; 53 per cent is classified as Grade 2—good irrigated soil, and 22 per cent is Grade 3 or fair irrigated land.

The climate and soils of the proposed South Saskatchewan River area seem suitable for irrigation development. The need for irrigation and the probable success of it is greater in the southern portion of the area (near Elbow and Outlook) than in the northern segment (near Saskatoon). Experience in Alberta and elsewhere indicates that irrigation farming is rarely successful in areas where natural rainfall is sufficient to permit fair crop production. This fact would seem to urge caution in the extension of irrigation northward into the parkland belt.

In the Elbow-Outlook area it appears that irrigation could be established on a sound agronomic basis. The climate and soils of the area seem favourable for production of usual irrigated crops. Thus the question of ultimate success of the development seems to shift to economic and sociological considerations.

* Marshall, J. B. and A. E. Palmer. Changes in the nature and position of the soluble salts in certain Alberta soils after twenty years of irrigation, *Sci. Agr.* 19: 271-278, 1939.

Water Supply*

The purpose of the South Saskatchewan River Project is to irrigate an estimated 454,700 acres of land in Central Saskatchewan by constructing a dam across the South Saskatchewan River near Outlook. Associated with the plans for irrigation, it is proposed to develop hydro-electric power of which a part would be used to pump water to heights ranging from 15 to 120 feet to irrigate approximately 307,000 acres of the total area. In addition, it is proposed to create power for municipal and industrial uses. The Commission is requested to ascertain whether the economic and social returns are commensurate with the cost thereof.

Review of Physical and Economic Features

The economic feasibility of the proposed project depends upon various conditions and factors which may be briefly summarized as follows:

- ✓(a) The need for irrigation of the lands for increased crop production as compared with crops grown under the existing dry farming practice.
- (b) The suitability of the soils for good crop production under irrigation within the limits imposed by climatic conditions.
- (c) The topographic features with respect to roughness, steep or flat slopes which will permit irrigating the land by practical and economical methods.
- (d) The volume and rate of flow of water with attending unavoidable losses,

required for irrigation and power for pumping and other uses in relation to the available supply.

From various reports on climate, soil and crop production under dry farming methods during the past, it is indicated that conditions generally for a large part of the project would justify a conversion to irrigation farming if it is economically possible to do so. It is also apparent that a supply of water for domestic uses would meet an urgent need in municipalities and towns, and that power production would enhance domestic and industrial uses within limits of its economic production.

The largest and most costly part of the proposed project is the dam, the location of which is fixed by topography along the Saskatchewan River and by the geological formations necessary to the security of a very large dam. Aside from the dam there remains the cost of main and branch canals, lateral distributary systems with appurtenant structures and, in this case, provisions for a large amount of mechanical equipment for pumping water.

Irrigation Requirements

✓The volume of water supply and rate of flow for irrigation is based on certain definable but varying factors. The variations are the result of climate as influenced by temperature, length of growing season and rainfall; by soil condition; by kind of crops grown, and the average results of unregistered farm operations as related to land preparation; time of planting crops, and the efficiency of individual farm management.

* This section was prepared as a memorandum respecting requirements and water supply by D. W. Hays.

The effect of these many influences on irrigation requirements is not definitely predictable. The most influential factor is the volume and date of occurrence of rainfall. In wet years little or no irrigation is required whereas in dry years an abundant supply of water is needed. If a project is to be successful, the size of irrigation works and water requirements must be based on a reasonable assurance of fulfilment in dry years, not the driest year, but for a period of average dry years. Conversely, it is equally important that large and expensive works should not be built if years of sufficient to ample rainfall for crop growth will preclude continued practical irrigation.

Before proceeding to a review of the use of water, it is perhaps pertinent to the problem to give a brief description of irrigation factors and to explain the reasons for a considerable variation in the measure of these factors.

Irrigation Factor

This factor is the percentage of the gross irrigable area irrigated in one irrigation season. It will vary with climatic conditions, the progress of land development and in changes in crop production from growing grain to mixed farming and on to specialty crops. It will be affected by the areas of land summer-fallowed or left idle.

Duty of Water

This represents the quantity of water in depth on the land needed to produce the optimum growth of crops. It is legally fixed for administrative purposes by the "Irriga-

tion Act" and "Water Resources Acts" at 1.5 feet depth on the land and is expressed at 1.5 acre feet for the irrigation season May 1 to September 30. The Duty of Water will vary with the seasons, particularly with the date and amount of rainfall in relation to the requirements for the kind of crops grown.

Irrigation Period, Depth of Application and Ditch Head

These factors are inter-related in irrigation practice.

The average depth of water applied for one irrigation will approximate 6 inches on fairly well-prepared land but may exceed this amount on poorly prepared land particularly during stages of early farming practice. It may be reduced to 4 inches for well-prepared land and the method used for irrigating.

The length of irrigation period depends on the rate of flow of water supply or "ditch head".

These factors all combine to provide sufficient depth of irrigation within a period of from 12 to 20 days which will preclude deterioration and unequal growth of crops in a farm unit, and also prevent unnecessary waste of the irrigator's time. The usual request for water varies from 2.0 to 3.5 c.f.s. Too small a flow results in over-soaking land near the source of supply and inability to spread water. Too large a flow may result in waste and possible damage to the farmer's own or his neighbour's crops. A sufficient ditch head is a highly valued asset to the irrigator about which he will vigorously complain in the event of short supply. In

these respects, however, there is a tendency to over-irrigate or demand more water than is actually needed, particularly by inexperienced and careless irrigators.

These conditions result in an irrigation demand and, under proper use, constitutes good irrigation practice in the best interests of the farmer which governs the purpose of the project.

Demand Factor

This is the aggregate of all ditch heads to be supplied in one irrigation period. The demand factor will vary largely with wet and dry years and be at its maximum in a dry year. If the maximum is assumed at 100% then the maximum canal supply, in theory, could be determined as follows:

Assume an area (A) of 5,000 acres, that the irrigation factor (I.F.) is 80%; that the average depth of irrigation (d) is 0.5 feet to be supplied in a period (p) of 16 days during a dry year of maximum use of water at 100%, then:—

$$(A) \frac{5,000 \text{ acres} \times \text{I.F.} 80\% \times (d) 0.5}{(p) 16 \text{ days} \times 2 \text{ (to reduce to c.f.s.)}} = \frac{2000}{32} = 62.5 \text{ c.f.s.}$$

Since, however, none of the above factors is definitely predictable, an over-all factor based on known conditions of flow in operated projects may supply the best answer.

Flow Ratio

This is a ratio expressed as that part of the gross irrigable area which could be supplied by 1 c.f.s. In the above case it would be $\frac{5000}{62.5} = 1 \text{ c.f.s. to } 80 \text{ acres gross irrigable area.}$

The use of this ratio is a convenient and practical method for determining the required size of main and branch canals. It is applicable to areas of sufficient size, 5,000 acres or more, to provide for average conditions for a number of farm units.

Seepage

Additional capacity must be made in all irrigation works to provide for seepage losses in the course of transportation of water from source of supply to the point of furthestmost delivery. Seepage losses vary with soil texture. In theory, for canals in prairie soils, it is frequently estimated at 6 c.f.s. per million square feet of the wetted area of the canal. This would be an intermediate factor between losses for clay loam and losses for sandy loam according to tests made many years ago by the United States Reclamation Service. No reliable information is available for canals operated in Canada.

Evaporation from reservoirs in the open prairie may be assumed at 2.5 feet depth per year varying from practically nothing in winter months to a maximum during July and August. Long days, high temperatures and dry winds increase evaporation losses.

It is perhaps pertinent to say that no branch of engineering work for which large amounts of money are spent, is subject to so many variable and unpredictable factors. In face of these conditions some of the large irrigation projects in Alberta were first built undersize as evidenced by enlargements made since the original construction. The possible exception lies in erroneous early judgment of the sustained need for irrigation wherein rainfall in excess of early expectations

resulted in sporadic use of irrigation and the ultimate conversion of the project largely to the needs for stock water. In these respects a fine line of demarcation may exist in the varied conditions of climate and soil conditions within a short distance or even within the limits of the project itself.

The degree of success of an irrigation project or part thereof depends on the yearly need and use of irrigation with a minimum of exceptions and not in the reverse order to the ultimate failure of its original purpose.

Review of Use of Water in Large Projects

The first large irrigation project in Canada was started about 1910. In the following few years three more large projects were under construction by private companies. In the early 1920's several irrigation districts were formed and works built. Except for small project extensions no new irrigation developments were undertaken until the starting of work in recent years by the P.F.R.A.

These older projects provide a history of irrigation developments in Canada and some measure of irrigation factors relative to the use of water. Unfortunately, they are not consistent each with another due partly to the method used in supplying water and procedure in keeping records. Data from some of the large projects have been obtained for the past ten years, 1941 to 1950 inclusive, as shown by Schedules 1a, 1b, etc. attached.

Table No. 1 is a summary of the average factors for the ten-year period.

Variation of Factors

The principal reason for differences in the foregoing summary is due to a common and convenient practice in some projects of turning more water into the main supply canal than is actually needed for crops, except possibly at maximum demand, and allowing the excess water to return to the rivers as waste water. Some variations occur due to the size of the project for which water is turned into the canals in anticipation of demands at remote parts of the project. Variations are expected due to local climatic conditions and kind of crops.

The Eastern Irrigation District, Schedule 1a, includes the irrigation of summer-fallow as a part of the irrigated area although water supplied is probably less than required for the cropped area. The area has been deducted in the summary in relation to Irrigation Factor to correspond with other projects. If the quantity of water used for summer-fallow were deducted, the Duty of Water for the cropped area would be higher. The Flow Ratio as shown is very high, being based on the diversion of 2600 c.f.s. from the river plus diversion from four reservoirs and therefore includes reservoir storage served to the lands under them. The Manager states:

"If the farmer will irrigate early, before the rush is on, the ditchrider will encourage him to take 4 to 5½ feet of water and finish his irrigation as soon as possible before the peak. We try to give each man 2 c.f.s. for each irrigation head during peak deliveries, allowing for topography of the area in which he lives.

The extensive distance of most all farm lands from our intake supply necessitates us keeping a constant stream in our canals and filling our reservoirs in anticipation of irrigation demands that could reach an intense peak in 36 to 48 hours. Quite often

TABLE NO. 1
Use of Water in Large Irrigation Projects Operated in Alberta

Year	Irrigation Factors			Duty of Water			Flow Ratio l.c.f.s. to gross irrig. area			Project	Miscellaneous Data						
	E.I.D.	L.N. I.D.	St. M. and M.R. I. Co.	E.I.D.	L.N. I.D.	St. M. and M.R. I. Co.	E.I.D.	L.N. I.D.	St. M. and M.R. I. Co.		Aver. farm units acres	Depth per Irrig.	Ditch head c.f.s.	No. Irrigations			
														Grain	Hay Past.	Beets	Canning
1941	84.2	75.9	75	69.5	1.38	1.58	1.19	1.05	68	E.I.D.....	140	6 in.	2 to 3	2	2	.....	3½
1942	88.8	39.1	45	69.7	0.76	1.78	1.22	.82	50	L.N.I.D...	160	6 "	2	2	2	3	3
1943	70.0	81.7	88	72.2	1.57	1.85	1.33	1.18	81	St. M. and M.R.....	110-120	6 "	2 to 3	2	3	3	2
1944	83.8	93.2	80	71.8	1.47	1.60	1.33	1.11	105	C. L. and I. Co.....	120	6" to 4"	2 to 3.5	2	.....	.....	.....
1945	82.0	70.6	75	68.9	1.29	1.48	1.16	1.09	81								
1946	87.7	85.2	90	75.5	1.30	1.47	1.36	1.07	102								
1947	85.7	72.3	85	78.1	1.13	1.34	1.13	.90	82								
1948	83.6	73.0	35	74.7	.92	1.10	1.22	.88	80								
1949	88.1	90.4	80	76.7	1.59	1.58	1.18	1.35	73								
1950	84.7	96.5	80	74.6	1.25	1.36	1.25	1.08	76								
Mean	83.8	77.8	73.3	73.2	1.27	1.51	1.24	1.05	84								
Length of irrigation period for Grain and Hay varies according to size of ditch head from 12 to 20 days for 160 acres. Irrigation of any crop will approximate 4 acres for each 1 c.f.s. of ditch head.																	

Length of irrigation period for Grain and Hay varies according to size of ditch head from 12 to 20 days for 160 acres.
Irrigation of any crop will approximate 4 acres for each 1 c.f.s. of ditch head.

Notes:
Irrigation Factors—exclude Summer-fallow.
Duty of Water—E.I.D. includes irrigation of summer-fallowed land.
L.N.I.D. includes seepage in canal and excess water.
St. M. & M. R. includes seepage and is short of water in some years.
C.L. & I. Co. shows net delivery to land.

Flow Ratio—E.I.D. not comparable with other projects as it includes total water diverted from Bassano Dam plus draft from four reservoirs without reference to reservoir inflow from Dam versus outflow of reservoir.
St. M. & M. R. to some extent may have low supply due to shortage of water. C. L. & I. Co. limited by canal size and could have used larger flow in some years.

an unexpected heavy rain forces us to spill water in the Bow or Red Rivers. During the customary three weeks' irrigation period, there is no extra water in our District and no water being spilled in any of our divisions."

The Lethbridge Northern Irrigation District operates on the principle of diverting more water than needed for crops with surplus water returned to the river of which a part, however, may be used on a rental basis.

The St. Mary and Milk River Project has to some extent been short of water for all periods of the irrigation season for which provisions are made in the construction of the St. Mary dam. There has been a tendency to irrigate early in anticipation of a shortage later in the season.

The Canada Land & Irrigation Co. Ltd. was under gradual and continued enlargements of its main canal with capacity barely sufficient to meet demands. There were no provisions for taking care of excess water, hence the operation of the canal was closely adjusted to actual crop needs with daily inspections at farm headgates. The data is therefore not comparable with projects where a surplus of water could be diverted. The crops in this project were largely grain with limited areas of hay and pasture crops.

For the Western Irrigation District (not shown in Table No. 1) the Manager states:

"Since the District was formed in 1944 there has been very little record of the irrigating done in the project. The farmers are largely wheat growers and do not wish to irrigate, but there is a tendency to go into livestock raising and mixed farming which will no doubt increase the use of water. In most years a fairly good crop can be grown without irrigation and irrigation is largely just an insurance against crop failure from drought."

The project has been in operation over 30 years and is still in a prospective stage in relation to irrigation needs as a result of borderline climatic conditions and the farmer's attitude toward irrigation where average rainfall will produce fair to good grain crops in most of the years.

Proportionate Use of Water in the Irrigation Season

Data to show the proportionate use of water during the irrigation season will vary with the seasons and kind of crops grown. Where grain is the major crop, large quantities are required, usually in the period of 15th June to 15th July, with little or no irrigation in August and September when grain crops mature and are harvested. With the inclusion of hay, pasture and vegetable crops, more irrigations are required extending into the late summer and fall.

Where diversions of water from the natural flow of a stream are made without storage regulation, the proportionate use by months is a matter for close attention in relation to water supply.

In the case of the South Saskatchewan River Project with a large reservoir planned for immediate and direct supply of water, the proportionate use of irrigation in the limited time of maximum demands will have little general effect on the reservoir supply, except in the matter of reservoir evaporation.

It is generally agreed that the maximum demands occur within a thirty-day period, June 15 to July 15, with variations in the succeeding months according to character

of crops. In order to correlate irrigation demands with the conventional records of stream flow and power load factors, the

requirements for irrigation are herein adjusted to calendar months.

A summary of data obtained is as follows:

Percentage of Use of Water by Months

—	April	May	June	July	Aug.	Sept.	Oct.	Total
								%
Lethbridge Ex. Station.....		10	20	30	20	10	10	100
St. Mary's and Milk River.....	03	17	19	24	16	12	09	100
C.L. & I. Co. (a).....		3.9	41.0	47.2	3.9	1.1	2.9	100
C.L. & I. Co. (b).....		5.3	32.2	38.5	10.0	6.5	7.5	100

(a) Delivery of water at farm unit headgates at Vauxhall.

(b) Flow of water at Drop No. 3 on Main Canal 20 miles above District and includes seepage to headgates and flow for summerflow and stock water in months August to October.

The records of the Lethbridge Experimental Station relate to use of water on a variety of crops grown and irrigated under careful supervision.

Records for the St. Mary and Milk River Project, years 1941 to 1950, are measurements at farm unit headgates for grain, hay, pasture and vegetable crops, and reflect the use of water for the latter crops in August and September. Early irrigations in April and relatively large amounts in May are partly attributed to the practice of farmers to irrigate when water is available in anticipation of a shortage of water later in the season which has occurred during the past for this Project. Excluding this condition, it is probable that less water would be used in May and more in June.

In the Canada Land & Irrigation Company Project at Vauxhall, where grain is the major crop, irrigation reaches its maximum in the period June 15 to July 15, shifting according to seasons, with little water used after July 20 except for stock water or summer-fallow land.

Early irrigation in May is largely for alfalfa and pasture. Grain crops are not usually planted and ready for irrigation before the latter part of May. Except where required for germinating seed, it is not practical to irrigate grain before the grain is well sprouted in order to avoid washing the soil surface and channelling in the process of irrigation.

Estimated Use of Water for South Saskatchewan River Project

The use of water as related to all irrigation factors must be predicated on an estimate of future development in the proposed project.

Like all projects, it is probable that agriculture under irrigation for some time will be confined to growing grain with gradual transition, in part, to hay and pasture for growing and fattening livestock with some areas in vegetable crops. It is not expected that a project of its size can be soon con-

verted to a highly developed project for growing sugar beets, canning crops and other specialty crops, which can be commercially produced in Canada, pending a very large increase in Canada's population and improved market facilities.

With respect to various factors the following suggestions are made:—

Irrigation Factor

In view of the probable production of grain crops for some years and concurrent need for summer-fallow, the Irrigation Factor will approximate 80 per cent.

Duty of Water

For actual use on grain crops it is probable that a "Duty of Water" of 1.3 feet would be sufficient in average dry years, no water being required for fall irrigations. Upon including hay and pasture crops with limited areas in vegetables requiring late summer and fall irrigations, the Duty of Water will increase. Taken together it is estimated that 1.5 acre feet may be required in average dry years.

Depth of application, period of use and ditch head are factors relative to size of lateral works required by farmers to irrigate crops without loss or waste of the irrigator's time. Provision should be made to deliver 3 c.f.s. to each farm unit subject to probable demands on the lateral system varying from 100 per cent for one farm unit to 70 per cent for an area up to 5,000 acres. This will provide for some leeway in ditch capacity for one lateral ditch system in relation to the average for several lateral ditch systems to be supplied by the main canal.

Percentage of Use during Irrigation Season

There will be some variations in the percentage of use of water by calendar months according to crops grown. It is anticipated for the South Saskatchewan River Project that grain will be the major crop for many years with gradual transition to livestock and mixed farming for a part of the area in due time.

Having regard to all conditions the following percentages of use are suggested:

May	June	July	Aug.	Sept.	Oct.	Total
						%
10	30	30	15	10	5	100

Small variations in percentage by months will not affect the reservoir supply except for minor changes in evaporation.

Flow Ratio

Regardless of any or all factors pertaining to irrigation, if the size of works will meet peak demands, then all other conditions can be fulfilled limited only by the available reservoir supply. Referring to flow ratios for operated projects, as shown by Table 1, it is suggested that 1 c.f.s. net delivered at farm unit headgates to 90 acres gross irrigable area should meet requirements. To the maximum rate of flow so determined provision must be made for seepage for which 6 c.f.s. per million square feet of wetted area is suggested.

Power Requirements

Power is required for pumping water from 15 to 120 feet above gravity supply level for approximately 307,000 acres. For this purpose average monthly requirements for power will approximate 25,000 H.P. during June and July. The remaining available water supply in the reservoir may be used for commercial power for which average monthly load factors as a percentage of peak loads in December, typical of operated plants, is estimated as follows:—

November	54%	March ..	46%	July	43%
December	58%	April ...	44%	August ..	45%
January	50%	May	43%	September	48%
February	49%	June	43%	October .	51%

Relation of Water Requirements to Water Supply

Table No. 2 attached shows available water supply in South Saskatchewan River for a period of 25 years which include seven successive years, 1934-35 to 1940-41, when the flow of water averaged less than any other corresponding period of record. The flow is taken from data compiled by the Prairie Province Water Board, Report No. 3, dated March, 1951, showing flow of South Saskatchewan River at boundary after Alberta's request for Red Deer and small irrigation (with Clearwater diversion) Condition B.

Table No. 3 is an estimate of water required for 454,700 acres at 80 per cent I.F. plus estimated seepage losses at 60 per cent from reservoir to land served. The estimated seepage is a mere guess pending data on the length and size of supply canals.

Table No. 4 shows estimated average power per month required to pump water for the areas of land to be served by pumps with estimated seepage losses reduced to 40 per cent to provide for that part of the canal losses from pumps to lands served. The quantity of water required for irrigation as per Table No. 4 is provided for in the estimates as per Table No. 3.

Tables Nos. 5a, 5b, etc. These Tables show the effect on the reservoir with dam in the Qu'Appelle Valley at Elbow for seven successive years in the relation of available reservoir supply to required outflow to meet demands under condition of the various factors used for irrigation and power.

The rate of flow of water from the reservoir for generating power will vary within the limits of the available power head between the maximum water surface elevation of the reservoir and the required supply level of water in the canal for irrigation. The maximum elevation of water surface in the reservoir is El. 1825, the full supply level of the canal El. 1800, and the bed of the canal El. 1787.5.

Preliminary trials have been made to ascertain whether or not the water supply in the reservoir, during the cycle of dry years 1933 to 1940, would provide for irrigation, pumping and the typical commercial power loads for a plant of 150,000 H.P. Another trial was made for a plant capacity of 120,000 H.P. In both cases the available water supply from the reservoir was insufficient to an extent that the reservoir draw-down depleted the water surface in the reservoir below the required elevation to supply the canal.

TABLE NO. 2

Showing flow of South Saskatchewan river at boundary after Alberta's request, Red Deer and small Irrigation (with Clearwater Diversion) condition B, as shown by records by Prairie Province Water Board Report No. 3, dated March 1951, Table 27

Years	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Totals C.F.S. Mos.	Totals Ac. Ft.
1923-24.....	4,671	3,817	3,646	4,072	3,962	1,259	7,497	13,506	7,586	9,531	4,558	3,603	67,708	4,062,480
24-25.....	4,363	4,095	3,908	4,250	8,445	13,527	11,692	14,614	6,767	7,330	7,750	9,242	95,983	5,758,980
25-26.....	6,005	4,676	4,064	4,026	9,280	7,285	2,100	4,939	5,673	3,771	20,080	13,894	85,793	5,147,580
26-27.....	7,793	5,352	4,622	4,473	6,365	13,836	16,878	39,008	21,417	15,381	17,747	10,800	163,672	9,820,320
27-28.....	6,594	5,425	8,429	5,738	13,203	9,632	12,739	36,512	30,023	7,264	5,211	5,942	146,712	8,802,720
28-29.....	5,620	4,060	4,614	4,140	6,712	3,041	8,894	24,053	1,859	1,621	1,831	3,723	70,438	4,226,280
29-30.....	4,025	4,325	3,879	6,438	6,014	5,850	6,946	7,830	6,080	1,982	2,288	4,278	59,935	3,596,100
30-31.....	4,288	4,482	4,048	3,811	3,831	2,023	1,495	3,416	2,144	1,039	2,064	4,601	37,242	2,234,520
31-32.....	3,630	3,329	3,443	3,486	4,686	5,094	8,303	29,297	7,472	2,304	4,560	4,025	79,629	4,777,740
32-33.....	4,525	4,277	3,913	3,993	4,819	4,265	18,552	16,120	5,667	1,105	1,804	2,820	71,860	4,311,600
33-34.....	6,228	4,866	4,941	5,321	4,699	6,496	14,800	16,406	2,896	798	1,601	4,491	73,543	4,412,580
34-35.....	6,102	4,185	4,356	5,288	4,794	5,338	4,463	9,553	8,155	6,733	2,456	3,668	65,121	3,907,260
35-36.....	3,932	3,547	3,114	3,491	6,510	10,696	5,853	7,290	1,033	1,016	1,313	2,465	50,260	3,015,600
36-37.....	3,193	2,552	2,738	3,109	3,982	3,533	1,697	9,168	1,459	1,005	1,857	3,437	37,710	2,262,600
37-38.....	4,587	4,452	4,201	3,645	5,734	6,891	9,394	13,076	9,221	3,461	4,527	4,679	73,868	4,432,080
38-39.....	4,525	4,115	3,647	3,389	5,549	3,822	2,906	12,001	6,485	1,529	2,367	3,533	53,868	3,232,080
39-40.....	4,326	3,578	3,574	3,539	5,483	9,582	8,203	3,894	2,456	2,148	3,783	5,495	56,061	3,363,660
40-41.....	4,977	4,120	3,619	3,809	5,987	3,862	1,600	2,447	2,031	1,344	3,206	5,038	42,040	2,522,400
41-42.....	4,415	3,702	3,594	3,221	3,892	3,672	15,193	23,041	19,866	11,728	9,004	6,712	108,040	6,482,400
42-43.....	4,919	3,956	3,815	4,548	6,755	21,050	5,208	14,369	12,142	3,853	1,732	3,259	85,926	5,155,560
43-44.....	3,647	3,806	3,740	3,636	3,585	2,349	251	7,164	5,166	7,452	3,167	2,813	46,776	2,806,560
44-45.....	3,523	3,659	3,431	3,486	5,467	2,365	6,192	19,401	8,421	3,160	4,624	6,351	70,080	4,204,800
45-46.....	4,192	4,520	4,443	4,024	7,032	6,670	5,389	19,989	8,748	2,415	6,909	5,588	79,919	4,795,140
46-47.....	5,049	5,155	4,649	5,639	13,385	13,770	17,023	17,228	10,010	4,676	6,706	10,005	113,295	6,797,700
47-48.....	6,977	4,530	4,297	3,983	6,261	25,338	48,653	48,938	12,496	10,736	3,470	.....	175,679	10,540,740

TABLE No. 3

Estimated water for 454,700 acres at 80% I.F. plus estimated seepage losses at 60% from reservoir to land

—	Pump Lift	Area— Acres	Net Area at 80% I.F.	May	June	July	Aug.	Sept.	Oct.	Totals	Totals ac. ft.
Percentage of Use.....				10%	30%	30%	15%	10%	5%	100%	
Depth per acre on land—ft.....				.15	.45	.45	.225	.15	.075	1.5 a.f.	
Assumed Losses at 60%.....				.09	.27	.27	.135	.09	.045	.9 a.f.	
Total depth per acre.....				.24	.72	.72	.36	.24	.12	2.4 a.f.	
<i>Water Requirements—</i> To land by gravity, Div. 1 to 5.....		147,700	118,160	473	1,418	1,418	709	473	287	4,778	286,680
<i>To be Pumped—</i> Divs. 6, 7 and 8.....	15'	42,850	34,280	137	411	411	206	137	69	1,371	82,260
Divs. 9 to 14.....	30'	106,150	84,920	340	1,019	1,019	510	340	170	3,398	203,880
Divs. 15 to 17.....	60'	79,400	63,520	254	762	762	381	254	127	2,540	152,400
Divs. 18 to 21.....	120'	78,600	62,880	251	755	755	378	251	125	2,515	150,900
Totals to lands to be pumped....		307,000	245,600	982	2,947	2,947	1,475	982	491	9,824	589,440
<i>Totals—All Lands.....</i>		454,700		1,455	4,365	4,365	2,184	1,455	778	14,602	876,120

TABLE No. 4

Estimated H.P. required to pump water for 307,000 acres at 80% I.F. plus estimated seepage at 40% from site of pump to land assuming pump efficiency at 75% and transmission at 90% ef.

—	Pump Lift	Area— Acres	Net Area at 80% I.F.	May	June	July	Aug.	Sept.	Oct.	Totals	Totals ac. ft.
Percentage of Use.....				10%	30%	30%	15%	10%	5%	100%	
Depth per acre on land—ft.....				.15	.45	.45	.225	.15	.075	1.50 a.f.	
Assumed Loss at 40%.....				.06	.18	.18	.09	.06	.03	.60 a.f.	
Total depth per acre.....				.21	.63	.63	.315	.21	.105	2.10 a.f.	
<i>Water to be pumped—</i> Divs. 6, 7 and 8.....	15'	42,850	34,280	120	360	360	180	120	60	1,200	72,000
Divs. 9 to 14 incl.....	30'	106,150	84,920	297	892	892	446	297	148	2,972	178,320
Divs. 15 to 17 incl.....	60'	79,400	63,520	222	666	666	333	222	111	2,220	133,200
Divs. 18 to 21 incl.....	120'	78,600	62,880	220	660	660	330	220	110	2,200	132,000
<i>Totals.....</i>		307,000	245,600	859	2,578	2,578	1,289	859	429	8,592	515,520
Divs. 6, 7 and 8.....	15'			303	908	908	454	303	151	3,027	
Divs. 9 to 14.....	30'			1,498	4,495	4,495	2,247	1,498	749	14,982	
Divs. 15 to 17.....	60'			2,240	6,720	6,720	3,360	2,240	1,120	22,400	
Divs. 18 to 21.....	120'			4,440	13,320	13,320	6,660	4,440	2,220	44,400	
<i>Total H.P. (a).....</i>				8,481	25,443	25,443	12,721	8,481	4,240	84,809 =	45,552.600 KW Hrs

$$(a) \text{ H.P. at Power Plant} = \frac{\text{c.f.s.} \times \text{h}}{8.81 \times .75 \times .90} = \frac{\text{c.f.s.} \times \text{h}}{5.947}$$

TABLE No. 5a—1933-34

Service of Coteau reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Month	Load factor %	H.P. produced out of 100,000 H.P.	H.P. x 11	Mean Head (h) ft	Draft for power c.f.s.	Draft for Irrigation		Evaporation		Total draft sum of 5, 8 and 11	Inflow 1933-34 c.f.s.	Reservoir		Bal. in reser-voir, end of Mo. c.f.s.	Waste 17
						To land Table 3 c.f.s.	For pumping Table 4	Mean area per acres	Rate per mo.			Net stored c.f.s.	Net draft c.f.s.		
Nov. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nov.	54	54,000	594,000	178.0	3,337	.....	.....	96,200	.....	3,337	6,228	2,891	.....	50,000	.....
Dec.	58	58,000	638,000	178.5	3,574	.....	.....	97,700	.....	3,574	4,866	1,292	.....	52,891	.....
Jan.	50	50,000	550,000	179.0	3,072	.....	.....	96,400	.....	3,072	4,941	1,869	.....	54,183	.....
Feb.	49	49,000	539,000	180.5	2,986	.....	.....	99,000	.....	3,152	5,321	2,169	.....	56,052	.....
Mar.	46	46,000	506,000	181.5	2,799	.....	.....	100,100	.....	3,049	4,690	1,650	.....	58,221	.....
Apr.	44	44,000	484,000	183.5	2,637	.....	.....	102,500	.....	2,979	6,496	3,517	.....	59,871	.....
May	43	43,000	473,000	185.0	2,556	.....	.....	104,000	.....	4,948	14,800	3,279	.....	63,388	.....
June	43	43,000	473,000	185.0	2,556	1,455	504	1,959	.....	8,953	16,406	.....	.....	66,667	6,573
July	43	43,000	473,000	184.0	2,571	4,365	1,521	5,886	.....	9,315	2,896	.....	.....	60,248	7,453
Aug.	45	45,000	495,000	180.0	2,750	2,184	777	98,500	.....	6,532	798	.....	.....	54,514	.....
Sept.	48	48,000	528,000	177.0	2,983	1,455	527	95,000	.....	5,440	1,601	.....	.....	50,675	.....
Oct.	51	51,000	561,000	177.0	3,170	1,778	263	95,000	.....	4,527	4,491	.....	.....	50,639	.....
Totals	47.8%	574,000	.....	.....	34,991	14,602	5,104	.....	2.5	58,878	73,543	16,667	16,028	.....	14,026

Col. 7. Amount of water under given head (h) required to produce power to pump water as shown by Table 4, i.e., cfs = $\frac{HP \times 11}{h}$

TABLE No. 5b—1934-35

Service of Coteau Reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Month	Load factor %	H.P. produced out of 100,000 H.P.	H.P. x 11	Mean Head (h) ft	Draft for power c.f.s.	Draft for Irrigation		Evaporation		Total draft sum of 5, 8 and 11	Inflow 1934-35 c.f.s.	Reservoir		Bal. in reser-voir, end of Mo. c.f.s.	Waste 17
						To land Table 3 c.f.s.	For pumping Table 4	Mean area per acres	Rate per mo.			Net stored c.f.s.	Net draft c.f.s.		
Nov. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nov.	54	54,000	594,000	178.0	3,337	.....	.....	96,200	.....	3,337	6,102	2,765	.....	50,639	.....
Dec.	58	58,000	638,000	178.5	3,574	.....	.....	96,700	.....	3,574	4,185	611	.....	53,404	.....
Jan.	50	50,000	550,000	179.0	3,072	.....	.....	97,400	.....	3,072	4,356	1,284	.....	55,299	.....
Feb.	49	49,000	539,000	180.0	2,986	.....	.....	98,500	.....	3,164	5,288	2,124	.....	57,423	.....
Mar.	46	46,000	506,000	181.5	2,799	.....	.....	100,100	.....	2,500	4,794	1,745	.....	59,168	.....
Apr.	44	44,000	484,000	182.5	2,632	.....	.....	101,500	.....	2,990	5,338	2,348	.....	61,516	.....
May	43	43,000	473,000	182.5	2,571	.....	.....	101,500	.....	2,981	4,463	.....	.....	60,998	.....
June	43	43,000	473,000	184.0	2,571	1,455	511	1,966	.....	4,981	5,553	.....	.....	61,579	.....
July	43	43,000	473,000	184.0	2,571	4,365	1,521	5,886	.....	9,315	8,155	.....	.....	60,419	.....
Aug.	45	45,000	495,000	183.5	2,697	2,184	762	2,946	.....	6,497	6,733	.....	.....	60,655	.....
Sept.	48	48,000	528,000	181.0	2,917	1,455	515	1,970	.....	5,386	2,486	.....	.....	57,755	.....
Oct.	51	51,000	561,000	180.5	3,108	1,778	258	99,000	.....	4,474	3,688	.....	.....	56,949	.....
Totals	47.8	574,000	.....	.....	34,800	14,602	5,088	.....	2.5	58,811	65,121	11,694	5,384	.....	.....

Column 7. See note Table 5a.

TABLE No. 5c—1935-36
Service of Coteau Reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Month	Load factor %	H.P. produced out of 100,000 H.P.	H.P. x 11	Mean Head (h) ft	Draft for power c.f.s.	Draft for Irrigation		Mean area acres.	Evaporation		Total draft sum of 5, 8 and 11 c.f.s.	Inflow 1934-35 c.f.s.	Reservoir		Bal. in reservoir end of Mo. c.f.s.	Waste 17
						To land Table 3 c.f.s.	For pumping Table 4 7		Rate per mo.	Equi. c.f.s.			Net stored c.f.s.	Net draft c.f.s.		
Nov. 1 Forward from Oct. 31st, 1935..			3	4	5											
Nov. 54	54	54,000	594,000	180.5	3,291			99,000			3,291	3,932	641		56,946	
Dec. 58	58	58,000	638,000	180.5	3,534			99,000			3,534	3,547	13		57,587	
Jan. 50	50	50,000	550,000	180.5	3,047			99,000			3,047	3,114	67		57,667	
Feb. 49	49	49,000	539,000	180.5	2,986			99,000	-10	166	3,152	3,499	347		58,014	
Mar. 46	46	46,000	506,000	183.0	2,765			102,000	-15	271	3,036	6,510	3,474		61,488	
Apr. 44	44	44,000	484,000	184.0	2,630			103,000	-20	343	2,973	10,696	5,179		66,667	
May 43	43	43,000	473,000	185.0	2,556	1,455	504	104,000	-25	433	2,948	5,853			66,667	2,544
June 43	43	43,000	473,000	185.0	2,556	4,365	1,512	104,000	-30	520	2,953	7,290		1,668	66,004	905
July 43	43	43,000	473,000	182.0	2,589	4,365	1,538	101,000	-50	841	2,943	1,033		8,310	56,694	
Aug. 45	45	45,000	495,000	178.0	2,782	2,184	786	96,200	-50	801	2,782	1,016		5,537	51,157	
Sept. 48	48	48,000	528,000	175.0	3,017	1,455	533	93,000	-30	465	2,940	1,313		4,157	47,000	
Oct. 51	51	51,000	561,000	172.0	3,261	778	291	90,000	-20	300	4,630	2,465		2,165	44,835	
Totals	47.8	574,000			35,024	14,602	5,164	19,766	2.5	4,140	58,930	50,268	9,721	21,832		3,449

Col. 7. See note Table 5a.

TABLE No. 5d—1936-37
Service of Coteau Reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Month	Load factor %	H.P. produced out of 100,000 H.P.	H.P. x 11	Mean Head (h) ft	Draft for power c.f.s.	Draft for Irrigation		Mean area acres.	Evaporation		Total draft sum of 5, 8 and 11 c.f.s.	Inflow 1936-37 c.f.s.	Reservoir		Bal. in reservoir end of Mo. c.f.s.	Waste 17
						To land Table 3 c.f.s.	For pumping Table 4 7		Rate per mo.	Equi. c.f.s.			Net stored c.f.s.	Net draft c.f.s.		
Nov. 1 Forward from Oct. 31st, 1936..			3	4	5											
Nov. 54	54	54,000	594,000	172.0	3,455			90,000			3,455	3,193			44,835	
Dec. 58	58	58,000	638,000	171.5	3,721			89,050			3,721	2,552		260	44,575	
Jan. 50	50	50,000	550,000	171.0	3,216			89,000			3,216	2,738		1,169	43,406	
Feb. 49	49	49,000	539,000	171.0	3,152			89,000	-10	148	3,300	3,109		478	42,928	
Mar. 46	46	46,000	506,000	171.5	2,950			89,500	-15	224	3,174	3,982		191	42,737	
Apr. 44	44	44,000	484,000	171.5	2,828			89,500	-20	297	3,125	3,533		808	43,545	
May 43	43	43,000	473,000	170.0	2,782			88,000	-25	367	3,152	1,697		408	43,933	
June 43	43	43,000	473,000	171.5	2,782	1,455	548	88,000	-30	447	3,152	1,697		3,455	40,498	
July 43	43	43,000	473,000	166.0	2,849	4,365	1,632	89,500	-50	704	2,902	9,168		34	40,464	
Aug. 45	45	45,000	495,000	160.0	3,093	2,184	874	84,500	-50	662	2,849	1,439		8,164	32,300	
Sept. 48	48	48,000	528,000	157.0	3,363	1,455	594	79,500	-30	385	2,849	1,005		5,808	26,492	
Oct. 51	51	51,000	561,000	156.0	3,596	778	299	77,000	-20	253	4,926	3,437		3,940	22,525	
Totals	47.8	574,000			37,761	14,602	5,632	20,234	2.5	3,487	61,482	37,710	1,216	24,988		

Col. 7. See note Table 5a.

Service of Coteau Reservoir for irrigation of 45,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Col. 7. See note Table 5a.

Service of Coleau Reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Col. 7. See note Table 5a.

TABLE No. 5g—1939-40
Service of Coteau Reservoir for irrigation of 454,700 acres and water required for power to pump water for 307,000 acres plus commercial power up to a maximum of 100,000 H.P. plant

Month	Load factor %	H.P. produced out of 100,000 H.P.	H.P. x 11	Mean Head (h) ft	Draft for power c.f.s.	Draft for Irrigation		Evaporation		Total draft sum of 5, 8 and 11 c.f.s.	Inflow 1938-40 c.f.s.	Reservoir		Bal. in reser-voir, end of Mo. c.f.s.	Waste 17
	1	2	3	4	5	To land Table 3 c.f.s. 6	For pumping Table 4 7	Total for irrig. 8	Mean area acres. 9	Rate per mo. 10	Equi. 11	Net stored c.f.s. 14	Net draft c.f.s. 15	16	17
Nov. 1	Forward from Oct. 31st, 1939														
Nov.	54	54,000	594,000	157.5	3,772									23,677	
Dec.	58	58,000	638,000	157.5	4,051				77,500			554		23,231	
Jan.	50	50,000	550,000	157.0	3,503				77,500				473	23,758	
Feb.	49	49,000	539,000	157.0	3,433				77,000			71		23,829	
Mar.	46	46,000	506,000	158.5	3,192				78,500	.15	196			23,807	
Apr.	44	44,000	484,000	163.0	2,974				82,000	.20	273	2,095		25,902	
May	43	43,000	473,000	166.5	2,841	1,455	560	2,015	84,300	.25	351	2,996		32,237	
June	43	43,000	473,000	163.5	2,899	4,365	1,712	6,077	82,500	.30	412			35,233	
July	43	43,000	473,000	158.5	2,984	4,365	1,766	6,131	78,300	.50	652			29,739	
Aug.	45	45,000	495,000	154.0	3,214	2,184	908	3,092	74,600	.50	621			22,428	
Sept.	48	48,000	528,000	152.0	3,473	1,455	613	2,068	73,000	.30	365			17,649	
Oct.	51	51,000	561,000	152.0	3,691	778	306	1,084	73,000	.20	243	477		15,526	
Totals	47.8	574,000			40,027	14,802	5,865	20,467		2.5	3,241	12,558	20,202	16,003	

Col. 7. See note Table 5a.

A further trial was made for a plant capacity of 100,000 H.P. It is evident by the computations that the demands for irrigation and power cannot be continued into 1940-41, a very dry year, and maintain reservoir elevations above Canal F.S.L. A rough estimate of the deficit of water and effect on production of power is as follows:—

Yearly requirements of water for irrigation, evaporation and power for a plant of 100,000 H.P. at load factors used, approximates 60,000 c.f.s. mo. Reservoir inflow for 1940-41 was only 40,040 c.f.s. mo. a deficit of 20,000 c.f.s. mo. for the year. The deficit for 1939-40 below Canal F.S.L. approximates 13,000 c.f.s. mo; total 33,000 c.f.s. mo. If this amount is distributed over the period June 1936, when reservoir is full, to October 1941, total 65 months, then the average deficit of water per month is 508 c.f.s. or 6,096 c.f.s. mo. for a year. At an estimated

mean head of 170 feet this represents 94,200 H.P. The power production per year from a plant of 100,000 H.P. at load factors used is 574,000 H.P. Deducting 94,200 H.P., leaves 479,800 H.P. therefore:

$$574,000 : 100,000 :: 479,000 : (x) = 83,600 \text{ H.P.}$$

This represents roughly, on the basis of an estimated power head, the capacity of a plant which would prevent depleting the reservoir below Canal F.S.L. during the period June 1936 to October 1941.

Comparison Reservoir Outflow versus Inflow

The following is a summary of reservoir outflow in c.f.s. mos. required to meet irrigation and power requirements as determined by Tables 5a, 5b, etc. for the years 1933 to 1940 as compared with the average reservoir inflow for years 1928 to 1941.

Year	Draft for Irrigation	Draft for Pumping	Reservoir Evaporation	Draft for 100,000 H.P.	Total
1933-34.....	14,602	5,104	4,181	34,991	58,878
1934-35.....	14,602	5,088	4,231	34,890	58,811
1935-36.....	14,602	5,164	4,140	35,024	58,930
1936-37.....	14,602	5,632	3,487	37,761	61,482
1937-38.....	14,602	5,559	3,503	39,162	62,826
1938-39.....	14,602	5,651	3,458	38,585	62,296
1939-40.....	14,602	5,865	3,241	(a) 40,027	63,735
1940-41(b).....					
Averages.....	14,602	5,437	3,749	37,206	60,994

NOTE: (a) Deficit of 13,000 c.f.s. below Canal F.S.L. and (b) insufficient inflow to restore reservoir to supply canal.

The average inflow to the reservoir for 13 years 1928-29 to 1941-42 inclusive (see Table 1) was 59,352 c.f.s. mos.

Maximum Power Plant Capacity in Relation to Peak Loads

Computations for power are based on the average monthly power load in relation to the maximum peak load in December. In

similar manner a peak load for pumping will occur for ten days to two weeks in June or July for irrigation which will be considerably in excess of the commercial peak load for those months. This peak demand for irrigation is determined by the maximum flow

ratio, *i.e.* 1 to 90, plus losses. The maximum power requirement for pumping would be for a short period once a year for which, nevertheless, provision must be made from some source of power. The amount of this peak load is computed as follows:

Water for Irrig. to be supplied by pumping	Gross Irrig. Area: Acres	Max. Flow Ratio 1-90, c.f.s.	Est. Losses at 40% c.f.s.	Totals	Pump Lift: Feet	Required H.P. (a)
Divs. 6, 7 and 8.....	42,850	476	190	666	15	1,680
Divs. 9 to 14 inc.....	106,150	1,180	472	1,652	30	8,333
Divs. 15 to 17 inc.....	79,400	882	353	1,235	60	12,460
Divs. 18 to 21 inc.....	78,600	873	349	1,222	120	24,657
Totals.....	307,000	3,411	1,364	4,775	.....	47,130

$$(a) \text{ H.P. at power plant} = \frac{\text{c.f.s.} \times h}{8.81 \times .75 \times 90} = \frac{\text{c.f.s.} \times h}{5.947}$$

The above power peak load for pumping brings the maximum power requirements for a short ten days to two weeks period in June or July, viz:—

	H.P.	H.P.
Power for typical loads from 100,000 H.P. Plant	43,000	
Add for normal June or July peaks, say	40,000	83,000
Plus irrigation peak load as above		47,130
Maximum Capacity required		130,130
Available Capacity due to Water Supply		100,000
Deficit		30,130

On a comparable basis the peak load in June or July for 83,600 H.P. would be:—

	H.P.	H.P.
Power for typical loads from 83,600 H.P. plant	36,000	
Add for normal June or July peaks, say	33,000	69,000
Plus irrigation peak loads as above		47,130
Maximum Capacity Required		116,130
Available Capacity due to Water Supply		83,600
Deficit		32,530

It is indicated that the water supply would be short for peak irrigation requirements in June or July by about 30,000 H.P. and 32,500 H.P. in the respective periods for which auxiliary power must be provided.

A power plant of 130,000 H.P. or more could be maintained by the available reservoir supply in wet years. Its use, however, would be subject to the following conditions:—

- Insufficient water supply in dry years as in the period 1933 to 1941.
- The difficulty of supplying power if the irrigation peak load for ten days to two weeks in June or July creates a deficit for normal commercial load commitments, thereby resulting in shut-downs, power rationing or the need to purchase power for the short period from some other source.

It will be understood that the foregoing analysis of the use of water for irrigation is

based on the average conditions of a dry year with an Irrigation Factor at 80 per cent and Duty of Water at 1.5 acre feet. These factors may vary according to relative differences in the amount and dates of occurrence of rainfall. It also may be assumed that

seepage losses might be higher due to the sandy loam texture of soils as related to length and size of canals. These variations would have some effect up and down on the power potential in some years.

Cost for Pumping Water to Land

On the basis of commercial peak loads, the annual charge for power installation and transmission lines should approximate

\$20.00 per H.P. per year. At this value the cost per acre for power only to pump water to lands is estimated as follows:

Land	Gross Irrig. Area	Pump Lift Ft.	H.P. at Peak Load	Annual Cost at \$20.00 per H.P.	Cost Per Acre
				\$	\$
Divs. 6, 7 and 8.....	42,850	15'	1,680	33,600	0.78
Divs. 9 to 14.....	106,150	30'	8,333	166,660	1.57
Divs. 15 to 17.....	79,400	60'	12,460	249,200	3.13
Divs. 18 to 21.....	78,600	120'	24,657	493,140	6.27
Totals.....	307,000	.....	47,130	942,600	3.07

Upon adding the above average cost per acre for power only to the estimated cost for operation and maintenance for the irrigation works, including pumping plants, at say \$2.00 per acre (based on average cost for

Alberta projects) brings the total to over \$5.00 per acre per year. This is too much for the farmer to pay and does not include any charge for principal and interest for a water right.

Proposed Enlargement of Reservoir

Since the foregoing Memorandum was directed to the Commission, it has been found that the reservoir is to be enlarged by shifting the location of the dam in the Qu'Appelle Valley.

The enlargement is brought about by moving the site of the dam in the Qu'Appelle Valley to the 3rd Meridian some 20 miles east of the Elbow Crossing site as formerly planned. This is shown by map, profiles, etc. following Chapter 16, pages 104 to 107 in

the General Engineering Report, dated March 1952, submitted by the P.F.R.A. at the meeting in Washington, D.C., April 7, 1952.

The proposed enlargement appears to be planned for the purpose of obtaining additional storage of water for power during a cycle of wet years to provide for reserve storage of water for use during a period of dry years. Aside from this it is not clear from reports and data whether other features such

as conditions of foundations for dams, railway locations, facilities for supply of water to Moose Jaw or Regina, or other features enter into the reasons for the enlargement.

An estimate of reservoir service for the enlarged reservoir, determined for inflow versus outflow worked out for monthly periods by tables and chart would involve a large amount of detailed computations. For general purposes it is hoped that a Table as shown herein will suffice to provide for an approximate estimate of power potential in excess of the use of water for irrigation, seepage and evaporation and supply of water to Regina and Moose Jaw.

Comparative Reservoir Capacities and Areas of Water Surface

In reports of the P.F.R.A., references are made to a draw-down in the operations of the reservoir of 40 feet, whereas the full supply level is at Elev. 1825 and the Canal F.S.L. at Elev. 1800, difference of 25 feet. It is indicated in computations in our earlier memorandum that difficulties would arise in a cycle of dry years should the reservoir be drawn down for winter power below Canal F.S.L. in anticipation of spring inflow replenishing the reservoir to an elevation sufficient for irrigation. It might be possible to do so if the conditions of a very wet winter indicated a forthcoming high spring inflow but this may happen only occasionally and would be hazardous for irrigation requirements. It therefore appears advisable to consider the available capacity of the reservoir within the limits of full supply level Elev. 1825 and the Canal F.S.L. Elev. 1800.

The following shows the comparative capacities and areas for an enlarged reservoir

with dam in the Qu'Appelle-Valley at the 3rd Meridian and Elbow site as formerly planned.

	Capacity, acre feet	Equiv. c.f.s. mos.	Area Acres
Dam at 3rd Meridian—			
Elev. 1825.....	2,649,530	44,160	121,758
Elev. 1800.....			93,421
Mean Area.....			107,590
Dam at Elbow—			
Elev. 1825.....	2,282,251	38,037	104,000
Elev. 1800.....			79,631
Mean Area.....			91,815
Difference.....	387,279	6,123	16,975

Maximum Available Power

Table A is based on conjecture of possible reservoir operations under condition of having advance knowledge of inflow as shown by the records of inflow, by which the maximum power potential is determined for the period 1923-24 to 1947-48. For future use advance knowledge of inflow is not available. In practical operations there would be a tendency to draw on the reservoir excessively to supply water for a dry year assuming the next following year would be wet and refill the reservoir. This, however, does not always occur. Therefore, without advance knowledge of inflow as shown by the records on which Table A is based, it is probable that the power potential would be less than shown by Table A.

Table A is predicated on the following principles:—

- (a) The reservoir will not be depleted by draft for power, ending October or

during the winter, below Canal F.S.L. and then only if there is ample evidence of an abundant forthcoming inflow for the succeeding year's operations.

- (b) That the reservoir is refilled during relatively wet years as an assurance for future use in a dry year or period of dry years rather than to draw excessively on storage during a wet year and leave reservoir reserve in short supply.

(c)

	Acre	Ft.	c.f.s.	mos.
It is assumed that the maximum irrigable area is 454,700 acres for which water for irrigation plus seepage is estimated at	876,120		14,602	
The average area subject to evaporation will approximate 110,000 acres at an estimated loss 2.5' per acre including reservoir seepage	275,000		4,583	
Provision is made for water for the Cities of Regina and Moose Jaw	29,000		483	
Totals	1,180,120		19,668	
Assume the amount at 19,670 c.f.s. mos.				

TABLE A

Table showing water supply to reservoir less requirements for irrigation, seepage, evaporation and supply of water to cities of Regina and Moose Jaw, under assumed operations of reservoir with dam at 3rd meridian.

Year	Reservoir inflow c.f.s. mos.	Plus storage draft	Less to storage	Total reservoir supply c.f.s. mos.	Less for irrig., evap. and cities	Available for power c.f.s. mos.	Mean monthly flow c.f.s.	Est. average head (h) ft.	H.P. at 80% c.f.s. x h 11	Storage reserve c.f.s. mos.
1923.....	Assumed	Reservoir	Storage	Reserve,—						25,000
1923-24.....	67,708	20,000		87,708	19,670	68,038	5,670	175	90,200	5,000
1924-25.....	95,983		8,000	87,983	19,670	68,313	5,690	170	87,940	13,000
1925-26.....	85,793	2,000		87,793	19,670	68,123	5,680	170	87,780	11,000
1926-27.....	163,672		33,160	130,512	19,670	110,542	9,210	175	146,520	44,160
1927-28.....	146,712			146,712	19,670	127,042	10,590	185	178,100	44,160
1928-29.....	70,438			70,438	19,670	51,768	4,230	180	69,220	44,160
1929-30.....	59,935	12,000		71,935	19,670	52,265	4,360	175	69,360	32,160
1930-31.....	37,242	32,160		69,402	19,670	49,732	4,140	170	63,980	.....
1931-32.....	79,629		10,000	69,629	19,670	49,959	4,160	165	62,400	10,000
1932-33.....	71,860			71,860	19,670	52,190	4,350	165	64,700	10,000
1933-34.....	73,543		13,000	60,543	19,670	40,873	3,410	170	52,700	23,000
1934-35.....	65,121		5,000	60,121	19,670	40,451	3,370	175	53,610	28,000
1935-36.....	50,260	10,000		60,260	19,670	40,590	3,380	175	53,770	18,000
1936-37.....	37,710	18,000		55,710	19,670	36,040	3,000	170	46,360	.....
1937-38.....	73,868		14,000	59,868	19,670	40,198	3,350	170	51,770	14,000
1938-39.....	53,868	7,000		60,868	19,670	41,198	3,430	165	51,450	7,000
1939-40.....	56,061	5,000		61,061	19,670	41,398	3,440	165	51,600	2,000
1940-41.....	42,040	2,000		44,040	19,670	24,370	1,700	165	24,590	.....
1941-42.....	108,040		44,160	63,880	19,670	44,210	3,680	175	58,540	44,160
1942-43.....	85,926			85,926	19,670	66,256	5,520	180	90,330	44,160
1943-44.....	46,776	34,000		80,776	19,670	61,106	5,090	175	80,980	10,160
1944-45.....	70,080	10,160		80,240	19,670	61,570	4,960	165	74,400	.....
1945-46.....	79,919			79,919	19,670	60,249	5,020	165	75,300	.....
1946-47.....	113,295		33,000	80,295	19,670	60,525	5,050	175	80,340	33,000
1947-48.....	175,679		11,160	164,519	19,670	144,849	12,070	180	197,510	44,160

- (d) Table A is based on inflow for the period November 1 to October 31. Since the bulk of inflow occurs in the spring months, April to June inclusive, maximum storage in the reservoir would occur in July with depletion as at October 31 instead of being at full capacity i.e. 44,160 c.f.s. mos. as shown by the Table. It is probable that waste would occur in wet years during the spring months and therefore the power potential may be less than the amounts shown by Table A in such years. Irrigation requirements occur in the period May to October inclusive at variable amounts with very high peaks in June or July, which, however, in some relative degree, coincide with variations in reservoir inflow. In similar manner, water required for pumping varies with irrigation requirements, provisions for which are deduced from the total power potential as shown by Table B to obtain the net potential commercial energy. These variations may have some effect on the storage reserve from time to time and relative losses by evaporation.

In these several respects, as before stated, a more accurate accounting of reservoir service cannot be obtained short of detailed computations by months by Tables and Chart as shown in the earlier Memorandum.

Maximum Plant Capacity

Having regard to the average H.P. capable of production, as shown by Table A, it is

observed that potential power in excess of 75,000 H.P. occurs in eleven years out of the twenty-five years 1923-24 to 1947-48. Assuming an average annual load factor of 50 per cent this would provide for a plant capacity of 150,000 H.P.

Table B

Table B shows the total amount of energy per year to be obtained from regulated water supply, as per Table A, for a plant capacity of this size. A deduction for pumping water for irrigation in the months May to October inclusive, 45,552,600 K.W. Hrs. (see Table 4 above) is made to arrive at the balance of energy available for commercial use. For this purpose Table B indicates that an average of 371.4 M.K.W. Hrs. could be obtained over a period of 25 years, and is reduced to an average of 314.4 M.K.W. Hrs. for the 14 consecutive dry years 1928-29 to 1941-42.

A report by the P.F.R.A. entitled "Water Supply Study" dated January 1952, Page 5, under the heading "Firm Commercial Energy", states:

"The end result of the reservoir study was to discover just how much commercial energy could be produced *after* all other demands had been satisfied".

This presumably refers to supply of water for irrigation, pumping and water to Regina and Moose Jaw with attending seepage and evaporation losses. Then follows the statement:—

"It is found, using the above procedure, that this project could produce, each and every year, energy in the following amounts . . . total every year 326,500,000 K.W. Hrs."

TABLE B

Showing commercial energy available from a 150,000 H.P. plant at 50% load factor less energy required for pumping plants for irrigable lands estimated at 45,552,600 K.W. hrs.

The Table also shows the deficit in energy required to maintain a 150,000 H.P. Plant at a normal load factor of 50%.

Year	Max. H.P. per month at 80%	plant 150,000 H.P.	Energy per year M.K.W. Hrs.	Less for pumping M.K.W. Hrs.	Bal. for commercial use M.K.W. Hrs.	Deficit for 150,000 H.P. Plant— M.K.W. Hrs.
1923-24.....	90,200	75,000	489.4	45.5	443.9	
1924-25.....	87,940	75,000	489.4	45.5	443.9	
1925-26.....	87,780	75,000	489.4	45.5	443.9	
1926-27.....	146,520	75,000	489.4	45.5	443.9	
1927-28.....	178,100	75,000	489.4	45.5	443.9	
1928-29.....	69,220	69,220	450.6	45.5	405.1	38.8
1929-30.....	69,360	69,360	452.5	45.5	407.0	36.9
1930-31.....	63,980	63,980	417.5	45.5	372.0	71.9
1931-32.....	62,400	62,400	407.2	45.5	361.7	82.2
1932-33.....	64,700	64,700	422.2	45.5	376.7	67.2
1933-34.....	52,700	52,700	343.9	45.5	298.4	145.5
1934-35.....	53,610	53,610	349.8	45.5	304.3	139.6
1935-36.....	53,770	53,770	350.8	45.5	305.3	138.6
1936-37.....	46,360	46,360	302.5	45.5	257.0	186.9
1937-38.....	51,770	51,770	337.8	45.5	292.3	151.6
1938-39.....	51,450	51,450	335.7	45.5	290.2	153.7
1939-40.....	51,600	51,600	336.7	45.5	291.2	152.7
1940-41.....	24,590	24,590	160.4	45.5	114.9	329.0
1941-42.....	58,540	58,540	372.0	45.5	326.5	117.4
1942-43.....	90,330	75,000	489.4	45.5	443.9	
1943-44.....	80,980	75,000	489.4	45.5	443.9	
1944-45.....	74,400	75,000	489.4	45.5	443.9	
1945-46.....	75,300	75,000	489.4	45.5	443.9	
1946-47.....	80,340	75,000	489.4	45.5	443.9	
1947-48.....	197,510	75,000	489.4	45.5	443.9	
Totals: M.K.W. Hrs. for 25 years.....			10,423.0	1,137.5	9,285.5	1,812.0
Average for 25 years.....			416.9	45.5	371.4	72.5
Total M.K.W. Hrs. for 14 years—(1928-29 to 1941-42).....			5,039.6	637	4,402.6	1,812.0
Average for 14 dry years.....			355.9	45.5	314.4	129.4

It is difficult to reconcile the above statements with the figures shown by Table B for the individual years during 1933-34 to 1940-41. In these years the available commercial power varies from 305.3 M.K.W. Hrs. to as low as 114.9 M.K.W. Hrs. with an average, for the whole period 1928-29 to 1941-42, at 314.4 M.K.W. Hrs. The differences cannot be readily accounted for since the P.F.R.A. generally agreed in total with the amounts of water required for irrigation, seepage and evaporation.

Table B also shows the amount of auxiliary energy which would be required to maintain a Plant Unit of 150,000 H.P. at 50 per cent load factor amounting to an average of 129.4 M.K.W. Hrs. for the 14 dry years and varying from 36.9 M.K.W. Hrs. to 329.0 M.K.W. Hrs. Excluding the very dry year 1940-41, the average requirement would approximate 150.0 M.K.W. Hrs. To produce this amount of energy would require an auxiliary steam plant, or power from other sources, of 46,000 H.P. at 50 per cent load

factor to balance out the energy that should be supplied by a Plant Unit of 150,000 H.P. capacity.

Effect of Enlarged Reservoir

By changing the location of the proposed dam in Qu'Appelle Valley from the site at Elbow to the site at 3rd Meridian, the capacity of the reservoir is increased by 387,279 acre feet or its approximate equivalent 6,120 c.f.s. mos. The mean area of the reservoir is increased by 16,975 acres.

To make a comparison between the two reservoirs, tables similar to Tables A and B should be worked out to ascertain the commercial energy which could be obtained from the smaller reservoir. Some general observations respecting the merits of the larger reservoir, however, may indicate the need for a careful reconsideration of the enlarged reservoir.

Referring to Table A, in respect of available water for all purposes, the decrease in average surface area for the smaller reservoir of 16,975 acres at losses of 2.5 feet per acre for seepage and evaporation, amounts to 42,337 acre feet or its equivalent average of approximately 705 c.f.s. mos. This gain from evaporation would improve water supply for all years and be of particular benefit in the period of 14 dry years.

In respect of reservoir storage as shown by Table A, (with small adjustment) the decrease of storage capacity by 6,120 c.f.s. mos. would have no effect on the available supply for power in excess of 75,000 H.P., as shown by Table B, for the succeeding five years as there is surplus water supply in this period. The reserve storage ending

1928-29, however, would be reduced by 6,120 c.f.s. mos. leaving 38,040 c.f.s. mos. for the subsequent dry years ending 1931 when an empty reservoir is shown by Table A.

In the subsequent ten years, 1932 to 1941 inclusive, there would be no loss in storage reserve as the smaller reservoir would be sufficient to store and regulate the inflow for this period and incidentally recover 7,050 c.f.s. mos. gained by reduced evaporation. Again in 1942-43 the reservoir reserve would be depleted by 6,120 c.f.s. to 38,040 c.f.s. mos. which would affect the available supply ending 1945 but would gain by reduced evaporation.

The enlarged reservoir has the effect of losing power head for a given volume of inflow in dry years as the build-up in the reservoir would be slower in a large reservoir than it would be in a smaller one.

From an economic standpoint, the enlarged reservoir requires more right-of-way and the possibility, not clearly shown, of decreasing irrigable land in the Qu'Appelle Valley which may be covered by the larger reservoir.

For the purpose of supplying water to Regina and Moose Jaw—29,000 acre feet—a dam may be required at the 3rd Meridian to form a reservoir, but one of limited size would serve to make a reservoir sufficient to meet this requirement.

It is in these several respects that the enlarged reservoir might be considered.

Red Deer River Project

Under the terms of reference P.C. 4435 dated 24th August 1951 relative to the proposed South Saskatchewan River Project,

the Commission was requested to ascertain "whether the said project represents the most profitable and desirable use which can be made of the physical resources involved".

This request has directed the attention of the Commission to a former proposed project referred to as the "William Pearce Scheme" initiated about 1922, by which a part of the lands in the proposed South Saskatchewan River Project might be irrigated. In view of this possibility a review has been made of the available data pertaining to this early scheme and the subsequent plans and surveys which have been made for the Red Deer Project. It was thought to be possible that the proposed South Saskatchewan River Project and the proposed Red Deer Project might be joined to form the most profitable and desirable use of the physical resources involved.

Plans and Surveys

Altogether, six plans and surveys have been made. A seventh survey is now under way as an alternative in some respects to the original William Pearce Scheme. Three of the surveys involved plans for using Sullivan Lake as a reservoir and three to create reservoirs by dykes at the sites of Craig and Hamilton Lakes. These several plans and surveys have been reviewed and may be briefly described as follows:—

Diversion of Water to Sullivan Lake

Plan 1. (William Pearce Scheme). Under this scheme water was proposed to be diverted from the North Saskatchewan River into the Clearwater River and the combined

flow into the Red Deer River, whence by dam 175 feet high located on the Red Deer River in Section 4-38-25-4th, water would be diverted by canal 98 miles in length, including a large syphon across the Red Deer River, into Sullivan Lake. From Sullivan Lake water would be distributed to lands in Alberta (present Red Deer Project) and by way of Sounding Creek, canal and natural channels, to a proposed reservoir at Tramping Lake from which water would be delivered to lands in that part of the South Saskatchewan River Project west of the river.

The delivery of water could be extended by syphon to the east side of the river which, however, was not contemplated in the original plans. The project was estimated to supply water to a potential irrigable area of 1,410,980 acres, or such part thereof as might be found best suited to irrigation within limits of available and economical water supply.

Plan 2. As an alternative to the dam and diversion in Section 4-38-25-4 as above, it was planned to build a dam 90 feet high on the Red Deer River below the mouth of Ravin River and by canal, surveyed 94 miles in length, to join the canal 11 miles below the point of diversion as per Plan 1, and thence into Sullivan Lake, total length 171½ miles.

Plan 3. This plan provided for a dam 185 feet high located in Section 10-38-22-4 to create a reservoir in Red Deer Valley, Tail Creek and Buffalo Lake with total capacity of 1,000,000 to 1,500,000 acre feet by which a mean power head of 140 feet could be obtained to pump water, viz:

- (a) Into the canal at a point east of the syphon as per Plan 1, during May to

October against a mean head of 135 feet and thence into Sullivan Lake.

- (b) To trade winter power produced by a flow of 300 c.f.s. for riparian rights at the proposed dam for summer power from Bow River plants to pump water in the period May to October, as per item (a) into Sullivan Lake.

The following plans provided for use of reservoirs at Craig and Hamilton Lakes.

Plan 4. To transmit power as per item 3a or 3b of Plan 3 about 30 miles to a pump site at the east end of Buffalo Lake north of Stettler and raise water 50 feet into a canal 70 miles in length for delivery of water into Craig and Hamilton Lake reservoirs. This plan eliminates Sullivan Lake and by reason of elevation of the reservoirs, would not irrigate lands west of Berry Creek, unless further pumping were to be done to raise water against a head of 90 feet into Lanes Lake as an auxiliary reservoir or against a less head for use of water direct from the canal at a point below Federal.

Plan 5. A gravity canal diverted from the Red Deer River west of Ardley thence on the west side of the river through Haynes Creek Valley, thence around the north shore of Buffalo Lake and on to Craig and Hamilton Lake Reservoirs.

Plan 6. A dam about 175 feet high located 500 feet upstream from the railway bridge 3 miles north of Ardley. This dam would create a reservoir in the Valley of the Red Deer River extending into Haynes Creek Valley with capacity of about 300,000 acre feet. The canal would be diverted from the east side of the reservoir in Haynes Creek Valley thence along level to rolling ground to Tail Creek crossed by syphon, thence

eastward through very broken country following sloughs and depressions and heavy cuts to a summit north of Stettler and thence south and east to reservoirs at Craig and Hamilton Lakes.

Choice of Plans

Any plan by which lands east of the proposed Red Deer Project could be irrigated requires the use of Sullivan Lake as a reservoir, hence requires Plan 1, 2 or 3.

A considerable amount of investigation has been made of the available data relative to the different plans. With respect to the surveys for the original William Pearce Scheme Plan 1, a great deal of the survey data cannot be found and it is at present impossible to obtain a comprehensive knowledge of all the works involved and present estimates of cost.

Plan 2 was largely of a reconnaissance survey. It was abandoned in view of rough country, many large structural requirements and length of canal.

Referring to Plan 3, this involves raising Buffalo Lake to a point to cause a great deal of railway and highway damage and all water, including canal and reservoir losses, must be lifted 135 feet to flow into Sullivan Lake. Under this plan, with a mean power head of 140 feet to pump water 135 feet, it would require as much water for power as the quantity pumped, thereby resulting in a loss of 50 per cent of the available water for irrigation. The only advantage of using Buffalo Lake as a storage reservoir would be in eliminating storage on the North Saskatchewan, Clearwater and Red Deer Rivers as may be required for Plan 1.

The main canal would be shortened by 30 miles and an expensive syphon across the Red Deer River would not be required.

The following information relates to Plans 4, 5 and 6 for use in irrigating lands in the Red Deer Project.

Referring to plan (4), this plan eliminates Sullivan Lake. It would require about 40 per cent of the power needed for Plan 3a or 3b and is limited to use in the Red Deer Project.

In reference to Plan 5, no details are available but from comments obtained the plan was not acceptable because of length of canal line and property damage.

Plan 6, pending further investigation at present under way, has been the last recent plan for the proposed Red Deer Project. It too has objectionable and expensive features which are probably more than offset by the objectional features of other plans, but appears on the basis of surveys made to best meet the requirements for the Red Deer Project.

It would not serve to irrigate lands extending east into Saskatchewan.

Proposed New Plan

At the present time a new survey is under way.

This plan is understood to revert back to the use of Sullivan Lake as a reservoir, by whatever method may be best suited to getting water into that reservoir, and extend eastward by canal other than by the Sounding Creek location, as planned for the William Pearce Scheme, to irrigate an entirely new area of land reported to be of better general quality than the lands in the Red

Deer Project. These investigations are incomplete. It is probable that this plan would be an alternative to the original William Pearce Scheme for irrigating lands in Saskatchewan, and may require new surveys to obtain missing data in the original plans for the William Pearce Scheme, or some alternative in plans for obtaining water from the North Saskatchewan, Clearwater and Red Deer Rivers for diversion into Sullivan Lake.

Irrigable Lands

A general review has been made of the records pertaining to the irrigable lands in the Red Deer Project. Early estimates of the irrigable areas in this Project were very large. Later information indicates an area of approximately 500,000 acres, but upon completing topographical surveys and soil tests, this area may be further reduced. Much of the land in the drainage area of Berry Creek has been eroded and rough and includes inferior soils. The better lands are represented to be in and around the marginal areas of the drainage area but require water to be pumped to heights of 35, 60 and 90 feet. Including all areas in the Red Deer Project, it is possible that the maximum area of irrigable land of fair quality would not exceed 300,000 acres.

Pending a very material improvement in farm values, an important economic question arises as to pumping water in excess of 60 feet, and then only if auxiliary reservoirs are available to supply the very irregular direct demands for irrigation. This condition applies to a large area in the proposed Red Deer Project and also in the South

Saskatchewan River Project. This may warrant, for the time being, a considerable reduction in the area proposed to be irrigated in both of the projects pending the outcome of farming developments as well as the availability of water supply.

Water Supply

Water supply from the Red Deer and Clearwater Rivers has been reviewed and an extensive compilation of records made to ascertain the probable available supply which would be of use to the Red Deer Project. Records for the Red Deer River are relatively complete for the period 1912 to 1950, and for the Clearwater River from 1914 to 1930 and again for the period 1945 to 1950. For a period of 14 dry years, 1928-29 to 1941-42 inclusive, interpolations had to be made for the Clearwater River. As a result of these compilations it is estimated that an approximate average of 1,200,000 acre feet per year, subject to reservoir control and regulation of flow, would be available to a canal for diversion during the months May to October for use in the Red Deer Project. The losses of water by seepage and evaporation would vary with length of canal and reservoir facilities used according to plans adopted.

For purposes of a rough analysis an estimate of three acre-feet per acre to supply irrigation and losses would provide for the irrigation of 400,000 acres of land. If the water in excess of the needs for the Red Deer Project were to be used to irrigate lands east of the Red Deer Project, further losses would occur so that taken together a total of say 350,000 acres may be the limit of area irri-

gable by waters of the Red Deer and Clearwater Rivers. Any additional area extending to the South Saskatchewan River Project, for which present surveys now under way may apply, would require diversion of water from the North Saskatchewan River as planned in the original William Pearce scheme about which, as stated, much data is missing.

In these various circumstances of incomplete plans and data, it at present appears that no definite report can be made relative to the possibility of using waters from the North Saskatchewan, Clearwater and Red Deer Rivers as an alternative to the plans for irrigating lands in the South Saskatchewan River Project from the Coteau Creek Dam.

It is assumed that the primary objective desired for the physical resources involved, is the use of the limited quantities of water, which can be economically made available, to irrigate land with power as an incidental feature. Power can be obtained at points which would not affect irrigation or by steam plants using the large resources of coal, oil or gas which occur in abundance in Alberta and Saskatchewan.

In several respects, as related to the physical aspects pertaining to the two projects, the following features warrant specific consideration:

- (a) The advisability of attempting to irrigate land requiring a pump lift in excess of 60 feet and then preferably if water can be pumped into an auxiliary reservoir to supply the irregular demands for irrigation. This would apply to an area of 78,600 acres in the South Saskatchewan

River Project for which water is required to be pumped 120 feet, and to areas requiring a 60 foot lift if auxiliary reservoirs are not available. It also applies to areas in the Red Deer Project where a large area of the better land requires water to be pumped 90 feet. These are subject to future developments in farm values.

- (b) The power potential for commercial use in the South Saskatchewan River Project for the period of 14 consecutive dry years in relation to the output from a plant capacity of 150,000 H.P., and the amount of auxiliary power needed to sustain a plant of this size.
- (c) The advisability of enlarging the reservoir by dam in the Qu'Appelle

Valley at the 3rd Meridian as compared with the potential power available with a dam at Elbow.

- (d) The possible use of waters from the North Saskatchewan, Clearwater and Red Deer Rivers for Joint use in Alberta and Saskatchewan which may be conditional upon surveys now under way and at present indefinite as to areas of land and works involved.
- (f) The potential possibility of using waters tributary to the reservoir at Outlook on lands in Alberta by extensions of existing schemes excepting for the advisability, if economically possible, of aiding in the development of lands in Saskatchewan for national reasons.
- (g) The total estimated costs in relation to the benefits to be obtained.

SCHEDULE 1a
Relative to irrigation factors and crops grown in Eastern Irrigation District Project

Year	Gross Irrig. area acres	Area Irrig. during year (a)	Summer-fallow and idle land	Irrig. factor %	Duty of water		Flow Ratio		Aver. size farm unit	Kind of Crops					
					Amount used ac. ft. (b)	Ac. ft. per acre, depth	Max. flow c.f.s. (c)	Ratio to max. area		Grain acres	Hay and pasture acres	Sugar beets acres	Canning crops acres	Misc. acres	Total acres
1941	156,501	156,501	24,697	100 (84.2)	543,222 218,882	3.47 1.38	3,829	1—40.8	138	100,173	23,748	nil	nil	7,883	156,501
1942	158,793	158,793	17,788	100 (88.8)	456,346 120,518	2.87 0.76	3,207	1—49.5	138	101,020	27,694	nil	nil	12,291	158,793
1943	166,253	157,149	29,423	94.6 (70.0)	609,006 247,506	3.88 1.57	3,814	1—41.2	138	84,720	32,815	nil	nil	19,295	166,253
1944	165,386	162,086	23,419	98.0 (83.8)	650,602 239,453	4.01 1.47	3,799	1—42.7	139	93,565	34,975	nil	nil	13,427	165,386
1945	163,829	158,036	23,607	96.5 (82.0)	604,744 204,445	3.83 1.29	3,912	1—40.4	139	83,332	35,261	nil	nil	21,629	163,829
1946	164,790	161,807	17,328	98.2 (87.7)	591,330 210,746	3.65 1.30	4,118	1—39.8	140	85,117	37,583	nil	400	24,362	164,790
1947	167,758	165,336	21,586	98.6 (85.7)	467,398 186,840	2.83 1.13	3,920	1—42.2	140	98,411	29,689	nil	550	17,522	167,758
1948	172,914	171,331	26,744	99.1 (83.6)	391,794 157,557	2.29 0.92	4,117	1—41.6	140	99,831	32,908	nil	700	12,731	172,914
1949	177,084	176,486	20,382	99.7 (88.1)	647,358 279,860	3.67 1.59	4,129	1—42.7	141	112,172	32,463	nil	850	11,217	177,084
1950	177,759	177,359	26,286	99.9 (84.7)	398,479 221,507	2.25 1.25	3,807	1—46.4	141	102,238	32,686	nil	1,000	15,549	177,759

All summerfallow in the Eastern Irrigation District is irrigated and there is very little idle land.

	Grain		Hay	Sugar beets	Canning	Miscellaneous
	2	5	2	—	3 1/2	2
(1) Average number of irrigations per season.....	22	5	2	—	2 1/2	2
(2) Average number of days used for one irrigation.....	6	6	6	—	6	6
(3) Approximate depth of water for one irrigation.....	6"	6"	6"	—	6"	6"

NOTES: (a) Reported irrigated area includes summerfallow. Figures in () show Irrigation Factor with summerfallow deducted.
 (b) Under "Total Water Supplied", first figure represents total water diverted at Bassano Dam, and second figure—water delivered at farm headgates.
 (c) Represents diversion at Bassano Dam plus amounts of water drawn off Lake Newell, and the Cowoki, Douglas and One Tree Reservoirs.

SCHEDULE 1b
Relative to irrigation factors, crops grown and related data, water taken from Keho Reservoir, Lethbridge Northern Irrigation District

Year	Gross irrig. area acres	Area irrig. during year	Summer-fallow and idle land	Irrig. factor %	Duty of Water		Rainfall-Lethbridge	Flow Ratio		Aver. size farm unit	Kind of Crops					
					Amount used ac. ft.	Ac. ft. per acre depth		Total for year inches	Apr. 1 to Oct. 31, inches		Mx. flow c.f.s.	Ratio to max. area	Grain acres	Hay and Pasture acres	Sugar Beets Acres	Misc. vega. Acres
1941	52,289	39,708	.....	.76	63,001	1.58	16.34	12.72	16.34	632	1-82	160	no records were obtained of areas in grain, hay and pasture crops.	7,030	From 8,220 to 3,000 acres.
1942	52,278	20,334	.....	.39	36,349	1.78	20.63	16.46	20.63	455	1-115	160		8,220	2,500
1943	52,278	42,735	.....	.82	78,974	1.85	11.32	6.44	11.32	462	1-113	160		8,830	to 3,000
1944	52,074	48,567	.....	.93	77,753	1.60	15.15	9.71	15.15	404	1-128	160		9,010	
1945	51,959	36,701	.....	.71	54,399	1.48	20.47	13.58	20.47	545	1-95	160		9,350	acres.
1946	52,096	44,383	.....	.85	65,520	1.47	21.48	10.67	21.48	530	1-98	160	Waste water used for irrig. land adjoining district, balance to river.	9,330	acres
1947	52,067	37,643	.....	.72	50,460	1.34	23.84	16.05	23.84	539	1-96	160		9,450	per year.
1948	52,044	37,992	.....	.73	41,830	1.10	17.44	12.05	17.44	495	1-105	160		9,580	
1949	51,862	46,889	.....	.90	74,070	1.58	18.06	9.04	18.06	508	1-102	160		9,690	
1950	51,862	50,071	.....	.96	68,260	1.36	12.39	6.13	12.39	466	1-111	160		9,800	

- (1) Average number of irrigations per season.....
 (2) Average number of days per irrigation.....
 (3) Average size of ditch head—no difference for size of farm unit.....
 (4) Average depth of water per application.....

NOTE: Irrigation practice in this District is to turn on more water than used for crops with excess going back to river or used by farmers on land adjoining District who pick up waste water. The total flow includes lateral and main canal seepage and waste water thereby increasing duty of water.

Grain	Hay	Beets	Vegetables
2	2	3	3
Varies probably 15 to 20 days average 2 c.f.s. 6 inches			

SCHEDULE 1c

Relative to irrigation factors, crops grown and related data, St. Mary's and Milk River Project (formerly A.R. & I. Lethbridge-Coaldale)

Year	Gross Irrig. area acres	Area Irrig. during year	Summer-fallow and idle land	Irrig. factor %	Duty of Water		Rainfall		Flow Ratio		Aver. Size farm unit	Kind of Crops					
					Amount used ac. ft.	Ac. ft. per acre, depth	Total for year inches	Apr. 1 to Oct. 31, inches	Max. flow c.f.s.	Ratio to max. area		Grain acres	Hay and pasture acres	Sugar beets acres	Canning crops acres	Misc. acres	
1941	76,597	59,447	17,150	.75	70,600	1.19	16.34	12.72	649	118	120	No records			9,051	No records	
1942	76,767	34,545	42,222	.45	42,000	1.22	20.63	16.46	560	137	120	"			17,109	"	"
1943	75,706	66,621	9,085	.88	88,663	1.33	11.32	6.44	730	104	120	"			18,511	"	"
1944	75,725	60,580	15,145	.80	80,276	1.33	15.15	9.71	624	121	120	"			18,055	"	"
1945	75,766	56,824	18,942	.75	65,696	1.16	20.47	13.58	677	112	120	"			18,978	"	"
1946	76,013	68,417	17,596	.90	93,017	1.36	21.48	10.67	709	107	110	"			18,650	"	"
1947	76,207	64,775	11,432	.85	73,443	1.13	23.84	16.05	737	104	110	"			17,905	"	"
1948	76,351	26,723	49,628	.35	32,559	1.22	17.44	12.05	571	134	110	"			10,985	"	"
1949	77,225	61,780	15,445	.80	73,179	1.18	18.06	9.04	658	117	110	"			12,902	"	"
1950	77,674	55,245	22,429	.80	69,057	1.25	12.39	6.13	790	98	110	"			15,808	"	"

- (1) Average number of irrigations per season.....
 (2) Average number of days used for one irrigation.....
 (3) Approximate depth of water for one irrigation.....
 Average flow in c.f.s. or "ditch head" requested by farmers
 160 acre unit—3 c.f.s.
 80 acre unit—2 c.f.s.

Grain	Hay	Beets	Canning	Misc.
2	3	3	2	2
15	10	6	6	6
6"	4"	3"	3"	3"

Royal Commission on South Saskatchewan River

Relative to irrigation factors, crops grown and related data, Canada Land & Irrigation Company Project, Vauxhall, Alberta

SCHEDULE 1d

Year	Gross irrig. area Acres	Area irrig. during year	Summer-fallow and Idle land	irrig. factor %	Duty of Water		Rainfall		Flow Ratio		Aver. size farm unit	Kind of Crops		
					Amount used ac. ft.	Ac. Ft. per acre depth	Total for year inches	Apr. 1 to Oct. 31, inches	Max. flow c.f.s.	Ratio to max. area		Grain Acres	Hay and pasture Acres	Misc. vogs. Acres
1941	43,093	29,893	13,200	69.5	31,469	1.05	11.40	9.58	630	1-68	120	26,916	2,595	382
1942	43,427	30,245	13,182	69.7	24,724	.82	14.10	11.80	460	1-94	120	29,279	2,733	326
1943	43,701	31,476	12,225	72.2	37,220	1.18	7.50	5.16	536	1-81	120	25,372	3,851	470
1944	44,632	32,069	12,563	71.8	35,807	1.11	9.96	7.46	423	1-105	120	26,871	3,096	979
1945	45,373	31,300	14,073	68.9	34,009	1.09	9.74	7.54	557	1-81	120	25,530	3,215	2,554
1946	44,624	33,722	10,902	75.5	36,136	1.007	12.18	10.68	437	1-102	120	27,709	3,252	2,941
1947	44,959	35,115	9,844	78.1	31,783	.90	16.96	12.51	548	1-82	120	29,738	2,834	1,864
1948	45,954	34,348	11,606	74.7	30,264	.88	12.04	8.81	570	1-80	120	29,678	3,217	1,713
1949	48,759	37,440	11,319	76.7	50,653	1.35	12.86	8.39	668	1-73	120	32,260	3,013	2,108
1950	48,954	36,508	12,446	74.6	39,460	1.08	13.24	9.21	641	1-76	120	29,052	3,000	3,428
	453,476	332,116			351,525	1.05								

- (1) Average number of irrigations per season.....
 (2) Average number of days per irrigation.....
 (3) Average size of ditch head—no difference for size of farm unit.....
 (4) Average depth of water per application.....

Grain	Hay	Beets	Vegetables
2	2	—	3

Note: All water deliveries refer to net quantities delivered to farm units for irrigation and exclude seepage losses. Deliveries do not include stock water streams or flow for farm reservoirs.

An Estimate of Cost

Mannix Ltd. Report on South Saskatchewan River Project

August 11, 1952

The Royal Commission on
The South Saskatchewan River
Development,
Ottawa, Canada

Gentlemen:

Re: South Saskatchewan River Development

Following the request of the Commissioners on April 4, 1952, Mannix are pleased to submit herewith our estimate of cost on the reservoir works of the South Saskatchewan River Project which is represented in the attached schedules.

The estimate is based on the report and drawings supplied by the P.F.R.A. and covers the following items:

1. The Main Dam across the South Saskatchewan River, including the cost of unwatering, cofferdam structures and care of the river.

2. The construction of necessary spillway and outlet facilities at the Main Dam.

3. The Saddle Dam located in the Qu'Appelle Valley near the third meridian, and referred to as the "Third Meridian" Dam.

4. The dam across Coteau Creek.

5. The Powerhouse and auxiliary structures.

6. Highway and railway relocation, and a high fill across Aikto Creek and referred to as Elbow Railway Crossing.

7. Services and General Plant operation.

8. Land damage and acquisition.

9. Contractor's General Expense.

10. Allowance for Contractor's contingencies.

11. Escalation of wages and materials.

12. Engineering.

13. Interest during construction.

14. Contractor's profit.

The estimate does not include:

1. Irrigation structures, outlets or distribution system.

2. Contingencies for changes in design or over-run in quantities.

In the preparation of this estimate, Mannix Ltd. have availed themselves of the experience and professional knowledge of the following companies:

(1) Morrison-Knudsen Co., Inc.; (2) International Engineering Co., Inc.; (3) Caterpillar Tractor; (4) Bucyrus-Erie; (5)

Euclid; (6) John W. Stang Corp; (7) Noble Manufacturing Co.; (8) Bowdinson Manufacturing Co.

Mannix Ltd. believes this to be an accurate and comprehensive estimate of the project based on the information at hand.

All of which is respectfully submitted.

Yours very truly,
MANNIX LTD.
William T. Pyott
Chief Engineer

General Summary

Item	Description	Cost	Item No.	Item	Quantity
100	Diversion, Care of River, and Unwatering working places.....	\$ 2,821,000	200	MAIN DAM	
200	Main Dam.....	19,971,230	1.0	Clear and Grub	
300	Conduits and Intake.....	25,179,005	.1	Right Abutment.....	150 A.
400	Powerhouse Area.....	2,054,695	.2	Left Abutment.....	200 A.
450	Powerhouse and Switchyard.....	16,354,350	.3	Borrow Pits.....	— A.
500	Spillway.....	10,087,400	.4	Structure sites.....	— A.
600	Coteau Creek Dam.....	1,630,335	2.0	Strip and Waste	
700	Third Meridian Dam.....	4,721,650	.1	Right Abutment.....	158,000 cy
800	Elbow Railway Crossing.....	5,242,255	.2	Left Abutment.....	292,000 cy
900	Railway Relocation.....	2,857,690	.3	Plateau Section.....	33,000 cy
1000	Cement.....	8,368,665	.4	Borrow Areas.....	535,000 cy
1100	Operators Village.....	300,000	3.0	Exc. Impervious and Haul to Emb.	
—	Road Relocation and Bridges.....	3,000,000	.1	Right Abutment.....	2,256,000 cy
—	Miscellaneous Service and General Plant Operation.....	5,157,900	.2	Left Abutment.....	672,000 cy
—	Land Damage and Acquisition.....	600,000	.3	Left Abutment Trim.....	843,000 cy
—	Contractor's General Expense.....	12,301,400	.4	Plateau Section.....	608,000 cy
—	Allowance for Contractor's Contingencies.....	4,000,000	.5	Borrow Areas.....	15,614,000 cy
—	Escalation of wages and materials....	10,000,000	4.0	Exc. Pervious and Haul to Emb.	
—	Engineering.....	8,000,000	.1	Right Abutment.....	607,000 cy
—	Interest during Construction.....	6,125,000	.2	Left Abutment.....	646,000 cy
—	Contractors' Overhead and Profit....	15,000,000	.3	Left Abutment Trim.....	5,473,000 cy
			.4	Plateau Section.....	879,000 cy
			.5	Borrow Areas.....	4,219,000 cy
	Total.....	\$163,772,575	5.0	Exc. Shale for Cutoff and Waste	
100	DIVERSION AND CARE OF RIVER		.1	Right Abutment.....	63,000 cy
1.0	COFFERDAMS		.2	Left Abutment.....	22,000 cy
.1	Sheet Pile Cofferdam.....	L.S.	.3	Plateau Section.....	28,000 cy
.2	Pumping.....	L.S.	.4	Left Abutment Trim.....	32,000 cy
.3	Misc. Cofferdam and Dikes...	L.S.	6.0	Exc.-Common-Toe Drains	
.4	Bridge.....	L.S.	.1	Right Abutment.....	142,000 cy
.5	Rock fill.....	30,000 cy	.2	Left Abutment.....	90,000 cy
2.0	Wellpoints and De-watering...	L.S.	7.0	Exc.-Common-Surface Ditch	18,000 cy

Item No.	Item	Quantity	Item No.	Item	Quantity
200			300	CONDUITS AND INTAKE	
8.0	Foundation Preparation— Exposed Shale		1.0	Strip and Waste.....	54,000 cy
.1	Right Abutment.....	231,000 SY	2.0	Excavation—Impervious and Haul to Embankment.....	396,000 cy
.2	Left Abutment.....	149,000 SY	3.0	Excavation—Pervious and Haul to Embankment.....	586,000 cy
.3	Plateau Section.....	14,000 SY	4.0	Excavation Shale and Haul to Waste.....	605,000 cy
9.0	Place and Compact Impervious Fill in Dam		5.0	Foundation cleanup—Included in conc.	
.1	Right Abutment.....	5,086,000 cy	6.0	Concrete	
.2	Left Abutment.....	6,617,000 cy	.1	Class A in Intake Structure above El. 1670.....	39,885 cy
.3	Closure Section.....	4,895,000 cy	.2	Class B in Intake Structure below El. 1670.....	25,770 cy
.4	Plateau Section.....	889,000 cy	.3	Class B in Intake Portal Structure.....	6,785 cy
.5	Upstream Blanket.....	1,771,000 cy	.4	Class B in Intake Approach Channel Paving.....	18,640 cy
10.0	Place and Compact Pervious Fill in Dam		.5	Class B in Plate-lined Two Cell Blocks.....	407,060 cy
.1	Right Abutment.....	4,008,000 cy	.6	Class B in Plate-lined One Cell Block.....	6,070 cy
.2	Left Abutment.....	7,126,000 cy	.7	Class B in Plate-lined One Cell Block.....	14,135 cy
.3	Closure Section.....	5,590,000 cy	.8	Class C Concrete Fill.....	106,200 cy
.4	Plateau Section.....	470,000 cy	7.0	Reinforcing Steel.....	
11.0	Place only Gravel in Toe Drain Trench.....	29,000 cy	.1	Class A Concrete.....	4,400,000 lb
12.0	Place only Selected Pervious Fill in D.S. Filters and Toe Drain		.2	Class B Concrete.....	39,448,000 lb
.1	Right Abutment.....	428,000 cy	8.0	Longitudinal Water Stops in Conduit.....	38,400 lb
.2	Left Abutment.....	325,000 cy	9.0	Transverse Water Stops in Conduit.....	15,100 lb
13.0	Place only Gravel Filter under Riprap.....	299,000 cy	10.0	6" Plastic Joint between Con- duit Blocks.....	255,000 S.F.
14.0	Furnish and Place Riprap on Face of Dam		11.0	Conduit Liner—1¼" Steel Plate.....	33,000,000 lb
.1	Upstream Face.....	241,000 cy	12.0	Intake Tower Access (Re- placed by Access Tunnel) (See Item 22)	
.2	Downstream Face.....	58,000 cy	13.0	Intake Gates	
15.0	Furnish and Install Perforated Vit. Clay Pipe in Toe Drains		.1	Gates (16).....	1,280,000 lb
.1	12" Diameter.....	3,000 l.f.	.2	Guides (16).....	288,000 lb
.2	15" Diameter.....	3,000 l.f.	.3	Hoists (16).....	960,000 lb
.3	18" Diameter.....	2,700 l.f.	14.0	Concrete Conduit Plugs.....	3,500 cy
16.0	Furnish and Install 18" Dia- meter R.C. Pipe Outfall Drains with Cemented Joints	1,000 l.f.	15.0	Trash Racks	
17.0	Furnish and Install Piezo- meter Tips and Tubing.....	L.S.	.1	Racks.....	300,000 lb
18.0	Furnish and Install Piezometer Wells and Gages.....	L.S.	.2	Embedded Metal.....	75,000 lb
19.0	Furnish and Install Settlement Gauges.....	L.S.	.3	Gantry.....	18,000 lb
20.0	Additional Water for Com- paction.....	3,870 Mil. G.	16.0	Miscellaneous Metal.....	100,000 lb
21.0	Construction Bridge.....	Deleted			
22.0	Dredge Fill to El. 1646.....	2,145,000 cy			
23.0	Access and Haul Roads				
24.0	Snow Removal				

Item No.	Item	Quantity
300		
17.0	Electrical System.....	L.S.
18.0	Misc. Mechanical.....	L.S.
19.0	Water Level Recorder.....	L.S.
20.0	Formed Vents—Forms Only..	36,000 s.f.
21.0	Access to Intake Tower	
.1	Class A Concrete.....	5,670 cy
.2	Reinforcing Steel.....	366,000 lb
22.0	Elevator shaft to Intake Control Tower	
.1	Class A Concrete.....	1,185 cy
.2	Reinforcing Steel.....	124,215 lb
23.0	Elevator to Intake Control Tower.....	L.S.
24.0	Ladder—Including Landings	200 l.f.

We do not know what type of articulated joints will be used between major structures founded on shale or earth foundation, and have only made an allowance for conventional water stops of copper, steel, and rubber.

Item No.	Item	Quantity
400	POWERHOUSE AREA	
1.0	Excavation	
.1	Stripping.....	7,000 cy
.2	Exc. clay or sand.....	61,000 cy
.3	Exc. shale.....	248,000 cy
2.0	Foundation Seepage Protection.....	L.S.
3.0	Drain Tile	
.1	Furnish and Install Half Round 6" Diam.....	2,300 l.f.
.2	Furnish and Install Half Round 8" Diam.....	990 l.f.
.3	Furnish and Install Half Round 12" Diam.....	900 l.f.
4.0	Class A Concrete Stilling Basin Walls.....	40,200 cy
5.0	Class B Concrete	
.1	Surge Tank Base.....	4,800 cy
.2	Pavement 1 foot thick.....	6,400 cy
.3	Pavement 3 feet thick.....	9,500 cy
6.0	Reinforcing steel.....	2,900,000 lb
7.0	Steel Surge Tank.....	1,755,000 lb
8.0	Wye Branches—Steel.....	1,200,000 lb
9.0	Backfill—Upstream P.H.....	37,400 cy

We do not know what type of articulated joints will be used between major structures founded on shale or earth foundations, and have only made an allowance for conventional water stops of copper, steel, and rubber.

Item No.	Item	Quantity
450	POWERHOUSE	
1.0	Class A Concrete	
.1	Super Structure.....	4,700 cy
.2	Transformer Deck and Slab...	550 cy
2.0	Class B Concrete	
.1	Substructure.....	41,000 cy
.2	Switchyard Foundations.....	200 cy
.3	Curbs, Gutters and Misc.....	300 cy
3.0	Reinforcing Steel.....	1,800,000 lb
4.0	Copper Water Stops.....	12,800 lb
5.0	Structural Steel in Super Structure.....	1,430,000 lb
6.0	Structural Steel in Switchyard.....	685,000 lb
7.0	Misc. Embedded Metal.....	10,000 lb
8.0	Roofing and Flashing.....	31,000 lb
9.0	Partition Walls—8" Hollow Tile.....	8,000 s.f.
10.0	Concrete Floor Finish—1½" ..	4,600 sy
11.0	Checkered Steel Floor Plates..	16,000 lb
12.0	Steel Floor Gratings.....	12,000 lb
13.0	Misc. Architectural	
.1	Aluminum Angles for Contraction Joints.....	500 lb
.2	Abrasive Metal Stair Treads..	9,000 lb
.3	Metal Handrails.....	10,000 lb
.4	Metal Doors, Frames, Sash, Louvres, Hardware.....	1,500 s.f.
.5	Glass and Glazing.....	5,000 s.f.
.6	Painting Concrete Surfaces...	800 sy
.7	Painting Interior Metalwork and Equipment.....	L.S.
.8	Painting Exterior Metalwork and Equipment.....	L.S.
.9	Painting Submerged Metal Surfaces.....	800,000 s.f.
.10	Painting Contraction Joints...	500 sy
14.0		
.1	Exc. Switchyard—Uncl.....	50,000 cy
.2	Cable Tunnel.....	L.S.
15.0	Gravel Surf. Switchyard.....	10,000 cy
16.0	Landscaping.....	L.S.

Item No.	Item	Quantity
450		
17.0	Electrical Equipment	
.1	Main Generators, 30,000 KVA 80% PF.....	6 ea
.2	House Turbo-Generators, 4,000 KW.....	2 ea
.3	Elec. Stand-by Unit Diesel— 200 KW.....	1 ea
.4	Rotor Erection Pedestal.....	3,600 lb
.5	Main Transformers—Sing. Ph.	19 ea
.6	Aux. Transformer.....	7 ea
.7	Oil Circuit Breakers.....	14 ea
.8	Main Switchgear.....	L.S.
.9	Conduit.....	L.S.
.10	Power and Control Wiring....	L.S.
.11	Power Centres.....	L.S.
.12	Cable Trays.....	L.S.
.13	Unit Control Boards.....	6 ea
.14	Station Serv. Control Boards.	L.S.
.15	Lighting System.....	L.S.
.16	Grounding System.....	L.S.
.17	Telephone System.....	L.S.
.18	Carrier Current System.....	L.S.
.19	Shop Equipment.....	L.S.
.20	Metering Equipment.....	L.S.
19.0	Mechanic Equipment	
.1	Hydraulic Turbines and Gover- nors—34,500 hp.....	6 ea
.2	Powerhouse Bridge Crane— Cap. 275 T.....	1 ea
.3	Butterfly Valves.....	1,200,000 lb
.4	Draft Tube Gate Guides.....	130,000 lb
.5	Draft Tube Gates.....	74,000 lb
.6	Draft Tube Gantry—20 T....	15,000 lb
.7	Machine Shop Equipment....	
.8	Drainage and Unwatering System.....	L.S.
.9	Oil System.....	L.S.
.10	Comp. Air System.....	L.S.
.11	CO ₂ System.....	L.S.
.12	Raw Water System.....	L.S.
.13	Treated Water System.....	L.S.
.14	Heating System.....	L.S.
.15	Ventilating System and Air Conditioning.....	L.S.
.16	Tail-water Gauge and Appur- tenances.....	L.S.
.17	Piezometer Piping.....	L.S.
.18	Plumbing and Sanitation Faci- lities.....	L.S.

We do not know what type of articulated joints will be used between major structures founded on shale or earth foundations, and have only made an allowance for conventional water stops of copper, steel, and rubber.

Item No.	Item	Quantity
500	SPILLWAY	
1.0	Clear and Grub.....	22 AC
2.0	Strip and Waste.....	246,000 cy
3.0	Excavation.....	
.1	Pervious—Common.....	6,225,000 cy
.11	Pervious—Aggregates.....	2,000,000 cy
.2	Impervious.....	1,457,000 cy
.3	Shale to waste.....	1,998,000 cy
.4	Structural—Clay.....	12,000 cy
.5	Structural—Shale.....	2,000 cy
.6	Foundation Preparation.....	15,500 cy
4.0	Fill.....	
.1	Place only Pervious Fill.....	817,000 cy
.2	Place only Impervious Fill behind Chute Walls.....	50,200 cy
.3	Place only Impervious Fill in Cut-off Trench.....	383,000 cy
.4	Place only Pervious Fill for Roadway Bridge Abutments	45,100 cy
.5	Place only Graded Gravel for Filter Drains.....	21,700 cy
5.0	Pump and Unwater Working Areas.....	L.S.
6.0	Riprap in Stilling Basin.....	8,000 cy
7.0	Supply and Place Top Soil....	18,300 cy
8.0	Supply and Place Perforated Vit. Clay Pipe.....	
.1	6" Diameter.....	24,400 l.f.
.2	12" Diameter.....	26,400 l.f.
9.0	Supply and Place 12" Concrete Pipe.....	100 l.f.
10.0	Class A Concrete.....	
.1	Front Cut-off Walls.....	445 cy
.2	Wing Walls.....	23,500 cy
.3	Walls at Piers.....	4,700 cy
.4	Chute Walls.....	20,680 cy
.5	Stilling Basin Walls and Wings	36,250 cy
.6	Bridges.....	7,250 cy
.7	Concrete Block Out.....	90 cy
.8	Manholes and Catchbasins...	165 cy
.9	Concrete Backfill.....	2,510 cy

Item No.	Item	Quantity
500		
11.0	Class B Concrete.....	
.1	Approach Slab.....	4,000 cy
.2	Crest.....	10,300 cy
.3	Piers.....	12,555 cy
.4	Chute Floors.....	71,310 cy
.5	Stilling Basin Floor.....	47,530 cy
12.0	Reinforcing Steel.....	11,428,400 lb
13.0	Water Stops.....	
.1	Cooper—12".....	45,040 lb
.2	Stainless Steel—12".....	3,630 lb
.3	Rubber.....	660 l.f.
14.0	Expansion Joint—1/8" Mastic	131,930 sf
15.0	Staff Gauge.....	
16.0	Misc. Metal Work.....	692,930 lb
17.0	Cast Iron.....	11,000 lb
18.0	Tainter Gates.....	
.1	11 Gates.....	806,400 lb
.2	Guides.....	67,900 lb
.3	Hoists.....	11 ea
.4	Anchors.....	250,000 lb
19.0	Emergency Gate.....	
.1	Stop Logs.....	98,000 lb
.2	Stop Log Guides.....	31,700 lb
20.0	Structural Steel—Hiway Bridge.....	1,189,000 lb
21.0	Rocker Assembly—Cast Steel.	105,600 lb
22.0	Hand Rail.....	800 l.f.
23.0	Bubbler System.....	L.S.
24.0	Foundation Piezometers.....	L.S.
25.0	Electrical.....	L.S.
26.0	Control Building.....	L.S.

We do not know what type of articulated joints will be used between major structures founded on shale or earth foundations, and have only made an allowance for conventional water stops of copper, steel, and rubber.

Item No.	Item	Quantity
600	COTEAU CREEK DAM	
1.0	Strip and Waste	
.1	Dam Foundation.....	62,000 cy
.2	Borrow Areas.....	24,000 cy
2.0	Excavation—Impervious and Haul to Embankment.....	
.1	Dam Foundation.....	91,000 cy
.2	Borrow Area.....	613,000 cy

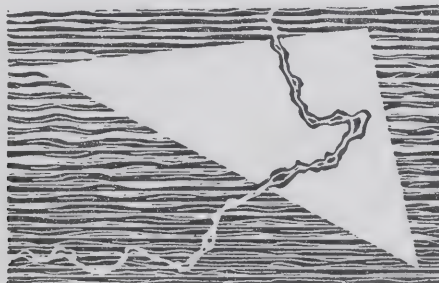
Item No.	Item	Quantity
600		
3.0	Excavation Pervious in Dam Foundation and Haul to Embankment.....	822,000 cy
4.0	Excavation—Shale in Dam Foundation and Haul to waste.....	21,000 cy
5.0	Foundation Preparation of exposed shale.....	5,300 cy
6.0	Common Escavation for Toe Drain and Haul to Embankment or waste.....	1,000 cy
7.0	Place and Compact Impervious Fill in Dam.....	1,708,000 cy
8.0	Place and Compact Previous Fill in Dam.....	1,498,000 cy
9.0	Furnish additional water for Compacting Fill.....	338 Mil. G.
10.0	Furnish and Place Gravel in Toe Drain Trench.....	1,100 cy
11.0	Place Select Pervious Fill in Downstream Filter Blanket and Toe Drain.....	60,500 cy
12.0	Furnish and Place Riprap on Upstream face to Dam.....	66,000 cy
13.0	Furnish and Place Gravel Filter Under Riprap.....	33,000 cy
14.0	Furnish and Install Perforated Vit. Clay Pipe in Toe Drain	
.1	9" Diameter.....	2,200 l.f.
.2	12" Diameter.....	2,000 l.f.
15.0	Diversion and Care of Creek...	L.S.

700

THIRD MERIDIAM DAM

1.0	Clear and Grub.....	None
2.0	Strip and Waste.....	
.1	Dam Foundation.....	177,000 cy
.2	Borrow Areas.....	165,000 cy
3.0	Common Exc. Dam Cut-off and Haul to Embankment or Waste.....	160,000 cy
4.0	Common Exc. for Upstream Blanket and Haul to Embankment or Waste.....	150,000 cy
5.0	Common Exc. for Toe Drain and Haul to Embankment or Waste.....	2,000 cy
6.0	Excavate Impervious and Haul to Embankment.....	6,364,000 cy
7.0	Excavate Pervious and Haul to Embankment.....	1,567,000 cy

Item No.	Item	Quantity	Item No.	Item	Quantity
700			800	ELBOW CROSSING	
8.0	Place and Compact Impervious Embankment.....		1.0	Clear and Grub.....	None
.1	Core of Dam.....	5,404,000 cy	2.0	Strip and Waste.....	
.2	Upstream Blanket.....	662,000 cy	.1	Foundation.....	117,000 cy
9.0	Place and Compact Pervious Embankment.....	1,567,000 cy	.2	Impervious Borrow Area.....	260,000 cy
10.0	Furnish Additional Water for Compacting Fill.....	417 Mil. G.	.3	Pervious Borrow Area.....	337,000 cy
11.0	Furnish and Place Riprap on Upstream Face of Dam.....	119,000 cy	3.0	Excavate Impervious Material and Haul to Embankment..	3,347,000 cy
12.0	Furnish and Place Gravel Filter under Riprap.....	60,000 cy	4.0	Excavate Pervious Material and Haul to Embankment..	2,315,000 cy
13.0	Furnish and Place Select Pervious Blanket under Downstream Pervious Zone of Dam.....	56,000 cy	5.0	Place and Compact Impervious Embankment.....	3,043,000 cy
14.0	Furnish and Place Gravel in Toe Drain Trench.....	1,500 cy	6.0	Place and Compact Pervious Embankment.....	2,315,000 cy
15.0	Furnish and Place Perforated Vit. Clay Pipe in Toe Drain.		7.0	Furnish Additional Water for Compacting Fill.....	530 Mil. G.
.1	12" Diameter.....	1,800 lf	8.0	Furnish and Place Riprap on Upstream and Downstream Slopes.....	210,000 cy
.2	15" Diameter.....	2,100 lf	9.0	Furnish and Place Gravel Filter under Riprap.....	105,000 cy
16.0	Furnish and Place 18" Diam. Conc. Drainage Pipe.....	1,500 lf	10.0	Conduit.....	
17.0	Conduit.....		.1	Struct. Excavation.....	4,000 cy
.1	Class A Concrete in Barrel Section.....	1,020 cy	.2	Class A Concrete.....	4,455 cy
.2	Reinforcing Steel.....	130,600 lb	.3	Reinforcing Steel.....	489,000 lb
.3	Rubber waterstops in conduit barrel.....	600 lf	.4	Pumping and Unwatering....	L.S.
.4	Structural Excavation.....	800 cy	11.0	Access and Haul Roads.....	L.S.
.5	Pumping and Unwatering....	L.S.			
18.0	Intake Tower.....	L.S.	900	RAILROAD RELOCATION	
19.0	Access and Haul Roads.....	L.S.	1.0	Build 32.8 M.—Abandon 27 M.....	
			2.0	Struct. Steel—Bridge and Dam	
			.1	Structural Steel.....	471,680 lb
			.2	Cast Steel—Shoes and Rockers	61,600 lb
			1000	CEMENT	1,497,000 bbls
			1100	OPERATORS' VILLAGE ...	L.S.



Long-Run Economic and Social Benefits

THE terms of reference of the present Commission ask the question "whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project would be commensurate with the cost thereof". The total cost in current prices of the South Saskatchewan River Project has been estimated at \$247,900,000. This estimate of cost will be referred to hereafter as the current *money* cost of the project and will be used in this chapter as the comparison base in a preliminary survey of the problems raised by the terms of reference quoted above. Later, in a following chapter, the question of cost will be re-examined in a more fundamental way to establish the real cost in terms of the immediate or short-run effects of the project upon the economy and the present and prospective status of the labour, materials, and other economic resources required in its construction. It is the purpose of the present chapter to attempt to assess the long-run economic and social benefits of the project. The emphasis here is upon the long-run effects and, as a matter of convention, these are taken to represent the yield or return to the Canadian people of the

S.S.R.P., as a multi-purpose, public investment project. The long-run economic benefits do not exhaust the whole field of possible economic benefits associated with the project, but it is more convenient to treat the economic benefits that may accrue in the short-run as reductions in the cost of the project rather than as additions to its yield.

The Problem of Identification of the Benefits of Public Investment.—As a public investment project, the S.S.R.P. must be considered within the general framework of public and private investment. In this context, investment means real investment or capital formation as conventionally defined; that is, the additions made during some period of time, usually a year, to structures of all kinds, machinery and equipment, inventories, and net claims against foreign assets. As a result of investment, the nation's productive capacity is maintained and augmented. Investment, by increasing productive capacity, makes it possible to increase the national product, or, what is the same thing, the national income.¹ It is this improvement in production and income and the greater well-being among members of the community that will normally accompany it, that justifies the investment

This chapter was prepared by Dr. K. A. H. Buckley, University of Saskatchewan.

¹Of the various aggregates in the National Accounts, the national product at factor cost, corrected for changes in the price level, is the most appropriate

measure of the real income of the community. The term 'national income' is used in the text to mean real national product or income, abstracting from changes that originate in changes in the value of money.

expenditures undertaken at any time. This aspect of the investment process is commonly referred to as the long-run production or income effect.

Investment is undertaken by private individuals, institutions, and business concerns with a view to recovering some part of this prospective yield. Generally, investment is made if the anticipated recoverable returns, appropriately discounted for risk, exceed the cost. In effect, the rational private investor will invest where the rate of return promises to exceed to the greatest degree the current interest rate for new capital. The rate of return in this context is the ratio of the anticipated increment in annual operating profits to the initial capital outlay.

The criteria governing public investment are much broader. The optimum capital structure from the public point of view is that which will make the largest possible contribution to the national well-being. Although private investment will normally increase national wealth and income, the optimum capital structure cannot be attained as the result of private investment alone because the increment in the national income accompanying many desirable investment projects cannot be recovered by private agencies to a sufficient extent to motivate private action. Canadian experience illustrates this fact, particularly in fields of transportation which, yielding little in the way of direct returns, were beyond the scope of private investment. On occasions in the past, public expenditures on roadbed and transportation equipment have made accessible great tracts of territory rich in agricultural, forest, and mineral resources, and thus have converted these into economic resources. These aspects of the physical

environment in an undeveloped and underpopulated half-continent became economic resources only after public investment made them attractive to labour and capital from abroad and from less remunerative occupations within the country. Throughout Canada's economic history, the creation of permanent economic opportunities in this fashion has been an important element in the increase of productive capacity and of national income, both in the aggregate and on a per capita basis. On these occasions, it has usually been the magnitude of the "indirect" returns accompanying investment in resource development that motivated the initial public action.

There is another important difference between public and private accounting of the long-run benefits of investment. The national income is only an approximate index of the real income enjoyed by the members of the national community. For example, the values of recreation, of health and education, of strengthening the general fabric of national production, and the value of national security are amenable to economic measurement imperfectly if at all, and, hence, cannot be fully covered in a national accounting of income and wealth. Yet these components of welfare are evaluated within the general democratic process and their respective weights do motivate, to some extent, the investment decisions of public authorities. Under ideal conditions, the returns or benefits from public investment are conceived in terms of the general welfare and all the economic benefits, whether recoverable or not, and the non-economic benefits are taken into account. This broader point of view is evident in the terms of reference of the present Commission.

The range of benefits relevant to this point of view may be broken down into three major classes:

(1) *There are the primary or direct economic benefits such as the net land rents created by an irrigation project.*—These benefits can be easily identified, measured in the same sense as the rate of return on private investment, and, if it be desired, recovered by some public agency or agencies. The total direct annual benefit is the sum of the annual income flows created directly by the project. This income can be distinguished analytically and statistically as an increment in the net national income, or as an increment in the nation's productive capacity.² Current estimates of the prospective annual benefits depend upon forecasts of future events and are therefore subject to error. There is a parallel between this class of benefit from public investment and the rate of return or yield on private investment. It is the only one of the three types of benefit discussed here which affects private decisions to invest.

(2) *There may be secondary or indirect economic benefits attributable to a specific investment project.*—These "returns" cannot be recovered by private agencies. However, they can be distinguished analytically and, where they exist, they appear as a further increment in the net national income or product in addition to the increase arising directly from the project. This class of benefits is emphasized in most discussions of the benefits of public irrigation projects, but

although they are tangible, a technique of measuring them has not been developed. The problem of identifying benefits of this type is dealt with below.

(3) *Finally, there are the broad social benefits of public investment projects.*—These benefits might be termed non-economic in character although it is difficult in practice to distinguish in a precise way the non-economic from the economic aspects of social organization. In general, benefits of this class are intangible, often difficult to identify, and impossible to measure even under ideal conditions.

Each of these classes of benefits will be examined in turn with specific reference to the S.S.R.P.

The Primary or Direct Economic Benefits of the S.S.R.P.

Irrigation.—The major purpose of the South Saskatchewan River Project is the irrigation of some 455,000 acres of land now producing under dry land farming practices. As a result of the project the effective productivity of this land would be increased and stabilized. Once created, the irrigation project would be expected to last indefinitely. The problem of estimating the direct economic benefit of the irrigation phase of the S.S.R.P. is the problem of isolating and measuring the increase in the annual net earning power or economic rent of the land. An increase in the economic rent of the land under irrigation would be an addition to the

is an increment in income from the project since a reduction in cost implies that economic resources are released from some present or potential use and available to produce other goods and services.

² A direct benefit to specific projects might take the apparent form of a reduction in cost, but the effect, from the standpoint of the national economic welfare,

national income and as such it would provide one offset to the annual interest charge on the capital cost of the project.³

Estimates of this phase of the economic benefits of the S.S.R.P. have been prepared under the direction of Professor H. Van Vliet.⁴ The procedure here will be to present a range of these estimates and one supplementary estimate in summary form and consider their implications as economic criteria of the feasibility of the project.

To apply a criterion of economic value in measuring the benefits of the S.S.R.P. is in effect to make an application of the principle of maximizing consumers' welfare within some assumed distribution of income. This procedure has its difficulties: the consumer needs under consideration lie far in the future, since irrigated production could only begin after a six to eight-year construction period and would scarcely approach full development within forty or fifty years.

The nature and degree of exploitation of the enhanced physical productivity of the Irrigation Area in the S.S.R.P. and the value of the resulting production will be determined by a wide range of dynamic factors bearing upon future market opportunities. Among these factors will be the tastes and consumption habits of consumers within the market scope of the Area, the population or

numbers of consumers affected, the level and distribution of their incomes, and the prices of related commodities. With respect both to the demand for products and to the competition in supply facing the Area, the character of future trade relations with other countries and the nature and extent of foreign trade will be important factors. Future technological developments introduce another element of uncertainty which is common to all capital projects of slow fruition and long life. Obsolescence is always a danger.

Survey of Assumptions Employed in the Determination of Irrigation Returns.—An appraisal of the irrigation phase of the S.S.R.P. must make assumptions, explicit or implicit, with respect to all the factors cited above. The strategic assumptions in *An Economic Appraisal* are summarized in two separate projections which are not themselves independent: the types and quantities of agricultural commodities produced in the Area; and the prices entering into the calculation of the cash receipts and the costs of production in the Area. These two projections are related since the structure of relative prices for agricultural products will be among the determinants of the types of commodities produced; and, if supplies from the Area form any significant portion of

³ This increment in rent would be a net gain if the rents earned by other land were unaffected by the development of the irrigation project. However, if as a result of the competition of the irrigation development, rent on adjacent dry lands—e.g., in the Saskatoon milkshed—were lower than they would have been in the absence of the S.S.R.P., then the virtual reduction in these land rents would have to be taken into account as an adverse indirect effect where the project is being viewed from the standpoint of the national interest.

⁴ H. Van Vliet, G. Haase and R. A. Stutt, *An Economic Appraisal of the Irrigation Phase of the Proposed South Saskatchewan River Development* (University of Saskatchewan, 1951). This appraisal, hereafter called *An Economic Appraisal*, was prepared

for the P.F.R.A., Department of Agriculture, Ottawa. The present discussion of the irrigation benefits is based upon it to a very large extent. *An Economic Appraisal* is a pioneering study in what is essentially a new field of research in Canada and the United States. It should be borne in mind that the study is a preliminary investigation. In the words of its authors: "Owing to incompleteness of the various phases of data, the dependence of the present study on the other phases of study, and the many uncertainties surrounding the estimates involved, the study is of an exploratory nature and its conclusions remain tentative". Cf. *An Economic Appraisal*, p. 1. The full text is available in mimeographed form in The Department of Agriculture, Ottawa.

total supplies in the markets to which they go, prices will be affected by the quantities of specific products sent to market. Similarly, costs may not be independent of the quantities of commodities sent to market if the demand from the Area forms a significant portion of the total demand for specialized services and materials.

Three specific types of farms were assumed to represent the potential types of farming in the Area:

- (1) specialized intensive crop farms with sugar beets as the representative specialty crop;
- (2) mixed grain-livestock farms with beef cattle as the chief livestock enterprise; and
- (3) general grain farms with wheat as the chief crop.⁵

On the basis of any reasonable projection of demand and technology, these farm-types would certainly appear in the Development Area. The important question from the point of view of the value of the project is the proportion of the Area devoted to the more intensive types of farming and particularly to the so-called specialty crops.⁶

No effort was made to project the future production experience of the Irrigation Area on an annual basis. However, in view of the long lag between initiation and full development of an irrigation project and the concomitant accumulation of interest upon the original capital costs, it was deemed advisable to estimate the economic status

achieved by the project at various stages in its development. The process of development may be broken down into three stages:

"Evolution of fully-developed irrigation production apparently involves three more distinctive stages. In the initial or developmental stage, farms are still undergoing development for irrigated use and basic practices in application of irrigation water are barely established. In the second, or transitional stage, introduction of the main forms of specialization relative to potentialities of irrigated production is in progress and a gradual improvement of irrigation practices is underway. In the third or mature stage, in turn, adjustments to use possibilities are largely complete and an effective basis of irrigation practices is generally established. The first stage is usually quite brief. The second, on the other hand, in terms of existing experience, is normally prolonged, often involving two generations of irrigation settlers and occupying periods of up to 30 and 50 years".⁷

For the present purpose a period of five years will be assigned to the initial stage and, assuming a highly progressive development, a period of thirty years to the second or transitional stage.

In the calculation of a weighted average return per irrigated acre in *An Economic Appraisal*, the proportions of the total irrigated acreage devoted to the three types of farming at each stage in the development were implicitly determined. In the initial period, the weights applied were 5, 10 and 85 per cent to acreage returns from specialty, grain-livestock, and grain farms, respectively; in the transitional period, the respective weights were 15, 25 and 60 per cent; and, in the mature period, 25, 40 and 35 per cent. These weights are described as "largely arbitrary . . . involving rough

⁵ The farm budget summaries for the three types of farm used in the estimation of irrigation returns in *An Economic Appraisal* are given in the appendix to this chapter.

⁶ In connection with specialty crops, the selection of sugar beets as a representative, high-return crop is

not meant to suggest that sugar beets would be the only specialty crop. The farm budget acreage involved might have been distributed among several specialty crops with little difference in the resulting estimates but a considerable complication in their calculation.

⁷ *An Economic Appraisal*, p. 64.

assumptions as to type-distribution of farms."⁸ Since the relative production of specialty crops that can reasonably be anticipated is among the crucial factors in determining the economic feasibility of the irrigation project, the implications of the weights assigned in the estimates of *An Economic Appraisal* deserve careful consideration.

On the basis of the assumed differentials in the size of the three basic types of farm, the weights used in the second or transitional stage allocate 42,000 of the 455,000 acres of irrigated land to specialty farms, with 12,600 of the 42,000 acres devoted to specialty crops and the remainder to other crops. In the mature stage the assigned weights allocate 79,000 of the 455,000 irrigated acres to specialty farms, with 23,700 of the 79,000 acres devoted to specialty crops. These are the estimates of the *effective* specialty crop acreage. However, it was further assumed in *An Economic Appraisal* that, in each stage of the development, there would be an equal or larger acreage of specialty crops spread among the other types of farms, but that this acreage would not have an income effect equivalent to the acreage in specialty farms. Consequently, no specific income allowance was made for it.

A more liberal weighting system can be justified by a consideration of the nature and results of a subsidiary study prepared by Dr. W. Darcovitch in conjunction with *An Economic Appraisal*.⁹ This study appraised the market possibilities for speci-

alty crops on the basis of a series of projections of the major determinants of market possibilities in the region. The market study assumed that the proposed Irrigation Area could share in the future increment in the beet sugar market in the prairie region and so capture about 20 per cent of the prairie market by 1971. It also assumed that the Area would supply potatoes to 55 per cent of the (census) urban population in Saskatchewan and fresh vegetables and a limited range of canning crops to the whole provincial population in 1971. The study made the further assumption that consumption per capita in 1971 would either remain at recent levels (e.g., sugar), or rise, as a result of higher Canadian incomes and nutritional standards in 1971, to the levels enjoyed in the United States from 1935 to 1939, (e.g., fresh vegetables, canning crops). The population estimates for 1971 were based upon the 1946 projections of the Dominion Bureau of Statistics.¹⁰ The so-called Estimate D of this publication was adjusted for apparent discrepancies with the official estimates of population in 1949 to obtain population estimates for 1971 and later years. The prairie component of Estimate D was similarly adjusted to the 1949 population and a further refinement applied by deducting an assumed level of net emigration down to the year 1956. The market study concluded that in 1971 the potential market for specialty crops could absorb the output of 35,000 acres in the proposed Irrigation Area.

⁸ *An Economic Appraisal*, p. 104.

⁹ W. Darcovitch, *An Appraisal of Market Possibilities for Specialty Crops in the Proposed Irrigation Area of Saskatchewan*, Farm Management Department, University of Saskatchewan. Cited in *An Economic Appraisal*, pp. 66-67.

¹⁰ D.B.S. *The Future Population of Canada, Bulletin F. 4* (Ottawa, 1946). This is the most recent official publication on the subject. Revised projections of recent date have a restricted circulation within official circles. It should be emphasized that projections of this kind are not intended as predictions.

The population projections deserve further consideration because, from the fundamental point of view of consumers' welfare, a need for large-scale irrigation in Canada will not likely arise unless the growth of population is sufficient to bring a considerably greater pressure upon available agricultural lands than now exists. The published projections of the Dominion Bureau of Statistics are hardly adequate for the analysis of future demands for food. Estimate D was based upon the fertility trend established in the period 1926 to 1940 with an allowance for an eight-year upsurge induced by war. The estimate also assumed that net migration would be zero. The soundness of the fertility trend itself may be questioned. In any event, it has been apparent for several years that the allowed upsurge was too short, and the adjustment made by Dr. Darcovitch was also inadequate on this point. From the point of view of predicting future population, there is the additional problem that the assumption with respect to migration abstracts altogether from the implications of the development of natural resources for capacity to absorb immigrants. As revised for the market study, Estimate D yielded a 1971 population for Canada 16 per cent above current levels. As a prediction, this estimate seems unduly pessimistic. A recent study of future demands for food in the United States anticipates a 28 per cent increase in the population of the United States from 1950 to 1975.¹¹ A comparison of past trends in net reproduction rates and of potential resource developments in the

two countries would hardly justify a smaller relative increase in Canada.

Another aspect of the market appraisal prepared by Dr. Darcovitch, and one which bears more directly upon the S.S.R.P., is the projected population for Saskatchewan and the prairie region. The prairie components of Estimate D were adjusted to allow for net emigration from the three provinces up to 1956. These adjustments result in population estimates for 1956 of 2,477,000 for the Prairie Provinces, and 824,000 for Saskatchewan. Since the 1951 census reports populations of 2,537,000 and 831,000 for the respective regions, the projections do not appear to exaggerate the potential growth.

On the basis of the foregoing discussion of Dr. Darcovich's appraisal, it may be concluded that his estimate of potential utilization in 1971 of some 35,000 acres for specialty crops is probably not unduly optimistic. In turn, his estimate may be compared with the estimates accepted in the weighting system described above. Assuming for the purpose of illustration that irrigation would begin in 1965, the initial stage in irrigation development would end about 1970, and the second or transitional stage would extend from 1970 to 2000. The weights employed in *An Economic Appraisal* imply that roughly two-thirds of the potential market of 1971 will have been tapped by 1985 (12,600 acres in specialty farms and an equal amount in other farms), and that at maturity, in the year 2000, a market about one-third larger than the potential market of 1971 will have been exploited (23,700 acres in specialty crops in specialty farms

¹¹ *Resources for Freedom*, a Report to the President by the President's Materials Policy Commission (Washington, 1952), Vol. I, Ch. 9; Vol. V, Ch. 7. This increased

population in the United States and the projected rise in income and per capita consumption are expected to increase the demand for food in that country by 41 per cent from 1950 to 1975.

and an equal amount in other farms). A more optimistic weighting will be introduced below in a supplementary projection of irrigation returns in the S.S.R.P.

The other major assumptions of *An Economic Appraisal* are those respecting price. Three sets of price-cost assumptions were employed in Professor Van Vliet's study to project a range of gross irrigation returns for each stage of the development.¹² In this context, "price" refers to the prices for farm products at the farm and "cost" refers to the prices entering into the cost of production, excluding capital costs of the irrigation project and irrigation operating costs. The price assumptions applied were:

- (1) the average of the relevant prices from 1921 to 1940;
- (2) the average of the relevant prices for livestock and specialty products from 1921 to 1948, and the average from 1921 to 1940 for grains; and
- (3) the average of the relevant prices from 1921 to 1948.

These will be referred to as the 1921-40 level, the 1921-48 partial, and the 1921-48 full level, respectively. Costs were adjusted in each projection to conform with the assumed price level.

The assumed prices were applied to physical outputs derived from current experience of the yields of irrigated land. Progressive development was introduced by assuming that yields would be 20 per cent lower in the initial or first stage than in the second, and, on one variant, 20 per cent higher in the third or mature stage than in the second, and, on another variant, 30 per cent higher in the third than in the second stage.¹³

With respect to costs, the level of operator's wage was assumed to rise from \$650 in the first stage to \$850 in the next two stages.¹⁴

Two sizes of farm were employed. The basic farm sizes selected implied an average of 144 irrigated acres per farm at full maturity. A larger variant was introduced by increasing the crop land per farm by 30 per cent.¹⁵

A fourth price assumption, not included in *An Economic Appraisal*, is added in this Report. Current agricultural prices and construction costs are both inflated in about the same degree with respect to their pre-war base. Both will be subject to cyclical and trend movements in the future. From the point of view of the analysis of benefits of the S.S.R.P., the trend movement in agricultural prices and the cyclical movement in construction costs are the important considerations. In this connection, it would be useful to compare the direct returns of the S.S.R.P. with its capital cost when both are measured in current prices. The 1951 level of agricultural prices will therefore be added as the fourth price assumption.

Other reasons may be adduced for applying the 1951 level of agricultural prices. One reason is that the current relative position of farm product prices is more consistent with the assumption of a long-run need for investment in increased land utilization than are the other three price assumptions cited above. On this ground, the 1921-40 level could be ruled out altogether. More than half of the twenty years in that period were years of relatively depressed farm prices. If

¹² *Resources for Freedom*, p. 84.

¹³ *Ibid.*, pp. 86-87.

¹⁴ *Ibid.*, pp. 81-82.

¹⁵ *Ibid.*, p. 85.

the average relative terms of trade of agriculture in the two decades from 1921 to 1940 were a fair reflection of the future trend, there would be little justification in extending agricultural resources. The interest would more likely be in reducing rather than increasing the stock of land employed in agriculture.

A second reason for projecting the current favourable relationship of prices bearing upon agriculture is that it is not unreasonable to assume that the future trend in this relationship may maintain or even improve upon the present relative position. An assumption of this nature is employed in a detailed study of future demands for food in the United States. The report to the President, *Resources for Freedom*, cited above, projects the 1950 average relationship between agriculture and other sectors of the economy to 1975, with allowance within the average for differential movements in individual prices to reflect differences in the projected condition of supply and demand for individual commodities.¹⁶ Recently the Governor of the Bank of Canada expressed the opinion that the current favourable position of relative prices for raw materials in general, including foodstuffs, may be a continuing one.¹⁷ It is possible that, as future prices unfold, the experience of the inter-war years will prove to be a deviation from the secular trend in relative price levels which was favourable to foodstuffs for over a century prior to 1920.¹⁸

The future position of farm product prices relative to other prices is only one aspect of the problem of the present appraisal. The position of future farm product prices relative to the level or levels of construction costs of the S.S.R.P. when these are incurred is also relevant. Farm products could greatly improve their relative price position in the future with widely different implications for the problem of capital cost reimbursement in the irrigation project depending upon whether the future general plateau of prices were higher or lower and in what degree. But this is an aspect of the question of the cost of the S.S.R.P. and is outside the scope of this chapter.

Estimates of Direct Returns to Irrigation in the S.S.R.P.—Table I presents projected gross returns per irrigable acre of the S.S.R.P. at each stage of its development on the basis of four combinations of the various assumptions discussed above.

TABLE I

Estimates of Gross Irrigation Returns per Acre for Respective Development Stages of the S.S.R.P.

—	Initial Stage	Transitional Stage	Mature Stage
Variant 1.....	\$ 0.23	\$ 1.39	\$ 4.09
Variant 2.....	2.04	4.02	6.93
Variant 3.....	3.19	5.14	9.66
Variant 4.....	9.21	14.11	21.45

the contrary view which is based upon the following premises: the relatively low income elasticity of the demand for food; the high rate of technological advance in agriculture; and the assumption that markets for western agriculture will be virtually restricted to countries of incipient population decline.

¹⁶ *Op. cit.*, pp. 73-75.

¹⁷ Cf. Graham Towers, *Some Aspects of International Trade*. An address to Investment Dealers Association of Canada annual meeting, St. Andrews-by-the-Sea, N.B., June 13, 1952.

¹⁸ Cf. T. W. Schultz, *Agriculture in an Unstable Economy* (New York, 1945), for the case supporting

Variant 1 is based upon the 1921-40 price level, the smaller farm size (144 irrigated acres), the 30 per cent rise in yields in the mature stage, and farm-type weights cited in the text.

Variant 2 is based upon the 1921-48 partial price level, the larger farm (188 irrigated acres), the 20 per cent rise in yields in the mature stage, and farm-type weights cited in the text.

Variant 3 is based upon the 1921-48 full price level, the larger farm, and the 30 per cent rise in yields.

Variant 4 is based upon the 1951 price level, the larger farm, the 20 per cent rise in yields in the mature stage, and with specialty farm weights in the transitional and mature stages double those cited in the text and the grain farm weight proportionately reduced. This implies that the effective specialty crop acreage would be about 35 per cent greater in the year 2000 than the Darcovich estimate for 1971. The operator's wage is assumed to rise from \$1,200 to \$1,500, in the transitional stage and to \$1,800 in the mature stage, instead of from \$600 to \$850 as in the other variants.

Each variant in Table I is a projection of a possible level of gross irrigation returns per irrigated acre at three points in the development of the project. For convenience these points may be dated at Years 3, 20 and 35, where Year 0 is the year of completion of the main dam and appurtenant works and Year 1 the year in which water is first applied to the land. It is assumed that construction of the irrigation system, beginning before Year 0, would be completed by Year 20.

Annual irrigation operating costs, exclusive of any capital charges, must be deducted from the gross returns of Table I to determine the net return or rent available to offset capital costs. One of the higher levels of operating costs projected in *An Economic Appraisal* on the basis of the 1921-48 price level may be used for this purpose in the first three variants. The level selected is \$1.50 an acre for gravity irrigation. This rate is raised to an average of \$2.30 over the irri-

gable area of 455,000 acres with the addition of pumping costs based on a cost rate for power of 5 mills per K.W.H. Average operating costs may be assumed to rise from \$1.50 an acre in the initial period of gravity operation to \$2.30 an acre when the whole irrigable area is under water.¹⁹ For the fourth variant, current levels of irrigation operating cost, as estimated for the Commission, were used. These are \$2.00 per acre for gravity irrigation, rising to \$4.07 per acre with the addition of pumping costs over the whole irrigable area.

TABLE II

Estimates of Net Irrigation Returns per Acre for Respective Development Stages of the S.S.R.P.

—	Initial Stage	Transitional Stage	Mature Stage
Variant 1.....	\$(-)1.27	\$(-)0.91	\$ 1.79
Variant 2.....	0.54	1.72	4.63
Variant 3.....	1.69	2.84	7.36
Variant 4.....	7.21	10.04	17.38

The result of applying the projected operating costs to the gross returns of Table I is shown in Table II. Variant 1 yields a negative result in the first two stages, which implies that, on this variant, the net rent and hence the value of the land under irrigation would be negative until after Year 25. Variant 1 is therefore omitted in Table III. Part A of Table III shows the value per acre of irrigated land at each stage of the development for Variants 2, 3, and 4; Part B shows the total value of the whole irrigated area at Year 20 and Year 35 for the same variants.

¹⁹ *Op. cit.* pp. 99-100.

TABLE III

Part A: Value of Irrigated Land in the S.S.R.P.
(dollars per acre)

—	Year 3	Year 20	Year 35
Variant 2.	\$ 15.40	\$ 49.20	\$132.41
Variant 3.	48.33	81.22	210.50
Variant 4.	206.31	287.14	497.07

Part B: Total Value of the Irrigated Land Area in the S.S.R.P.

(millions of dollars)

—	Year 3	Year 20	Year 35
Variant 2.		\$ 22.4	\$ 60.3
Variant 3.		37.0	95.8
Variant 4.		130.6	226.1

A rate of $3\frac{1}{2}$ per cent, which approximates the current, long-term, Federal interest rate, was used to capitalize the projected net rents of irrigated land.²⁰ The total land values of Part B, Table II, may be usefully compared with the total cost of the S.S.R.P. including acquisition of land costs, which would be \$247,900,000 on the basis of current prices. In this comparison the difference in the dates of the values should be borne in mind.

Direct Returns to Power in the S.S.R.P.

The value of the hydro-electric power that would be made available in the S.S.R.P. has been provided by the Province of Saskatchewan. The power estimate is attributed to the Prairie Provinces Water Board, *Water Study of S.S.R. Project*, Regina, 1952. It assumes 325 million K.W.H. of firm energy, 50 million K.W.H. for pumping, and an average of 100 million K.W.H. secondary.

The value of firm energy is taken at 5.5 mills per K.W.H. The current cost of power from Montana is 3.6 mills plus approximately 2 mills for transmission to Saskatchewan centres. It has been also stated by the Saskatchewan Power Commission that "large steam plants can produce power for 7.5 mills per K.W.H. and since they can be located close to local centres, 2.0 mills transmission costs must be subtracted to assess the value of hydro at Coteau." The value of secondary power is taken at 3.0 mills to allow "capital charges at 2.5 mills per K.W.H. on standby steam plant capacity."

It was assumed in the previous section that power for pumping would be charged against operating costs at a 5.0 mills rate. A value of 3.0 mills for pumping power implies a 2.0 mill cost for transmission of this power to the irrigation project.

Revenue from the sale of power in the S.S.R.P. would begin to accrue in Year 1 of the project. As the irrigation system developed, firm power would be shifted to pumping irrigation water with a 2.5 mill decline in revenue from the diverted power. A diversion of 50 million K.W.H. would be made by Year 20. The gross revenue from power may be calculated as follows:

375 million K.W.H. at 5.5 mills	\$2,062,500
100 million K.W.H. at 3.0 mills	300,000
Gross Revenue in Year 1	\$2,362,500
325 million K.W.H. at 5.5 mills	1,787,500
150 million K.W.H. at 3.0 mills	450,000
Gross Revenue in Year 20	\$2,237,500

²⁰ It is to be emphasized that this capitalization rate ignores the uncertainty involved in the price and other

projections. A risk premium would be added to the interest rate in a normal private calculation of future land values.

The Saskatchewan Power Commission assumes that the annual cost of operating this type of hydro plant is approximately nine per cent of capital cost, including capital charges at four per cent. If \$24 million of the total cost of the S.S.R.P. is to be attributed to the power plant, as established in a previous chapter, annual operating costs, excluding capital charges, would be \$1.2 million. If we deduct this cost from gross revenues, and capitalize the resultant net incomes at a rate of four per cent,²¹ which approximates the current long-term interest rate for the Province, the capital values created by the power project would be of the following order:

Year 1	\$29,062,500
Year 20	25,937,500

Direct Benefits to Municipal Water Supplies of the S.S.R.P.

The implications of an adequate water supply in Regina, Moose Jaw and other municipalities in the area are of obvious importance to these municipalities. The value attributable to the S.S.R.P. in this connection is the saving of the potential cost implied in the commitment of the Federal Government to insure an adequate supply of water by maintaining the level of Buffalo Pound Lake. This value would accrue in Year 1 of the project, and continue indefinitely. If the project were completed before 1980 there would be a write-off of the undepreciated portion of the capital cost of the temporary pumping system required to

maintain the level of Buffalo Pound Lake. Offsetting this loss would be a saving in capital cost of \$350,000 required in 1980 to establish the pumping system on a permanent basis.

The annual pumping charge that would be eliminated is \$150,000. This represents an equivalent capital sum in Year 1, at the current Federal rate of interest, of \$4,290,000.

A summary of the possible direct benefits of the S.S.R.P. indicates the strategic importance of the assumptions respecting future population and price levels. On the most pessimistic variant employed, the value of the three forms of direct returns would be \$91 million at maturity (Year 35). This leaves a wide margin between the direct returns and the cost to be offset by the value of the indirect economic returns and the social benefits. On the third irrigation variant, using the average price level from 1921 to 1948, and the more conservative weighting of farm types, the total value of the direct returns at maturity would be \$126 million. The margin between direct returns and cost is reduced by \$35 million on this variant. If the fourth irrigation variant can be accepted as most probable, the total value of direct returns at maturity would be \$256 million. The margin between returns and cost, on this accounting of the direct returns, becomes a surplus, and the indirect economic returns and social benefits are clear gains to be added to it. The following sections of this chapter consider some of the long-run indirect benefits that would accompany the project.

²¹ The rate suggested by the Saskatchewan Power Corporation. In the previous section of this chapter, a

rate of $3\frac{1}{2}$ per cent was used, without risk premium, in calculating the value of irrigation benefits.

Secondary or Indirect Benefits of the S.S.R.P.

A definitive appraisal of the secondary, long-run effects of the project is impossible owing to the deficiencies of current analysis with respect to identification of the indirect long-run effects of investment and of techniques of measuring the magnitude of the effects. Probably the appropriate criterion of economic benefit in this sphere is the change in the productive capacity of the community that accompanies the investment. A portion of this change in productive capacity has been treated in the previous section under the name of direct benefits. Any remaining increment in productive capacity induced by the initial investment is treated as an indirect or secondary benefit.²²

Many types of investment will have indirect effects upon productive capacity in this sense. A possibility that the magnitude of these indirect effects per dollar of investment is not always the same implies that they should be assessed as far as possible in establishing priorities between public and private investment alternatives, on the one hand, and among public investment projects, on the other.

The problem has been recognized explicitly in Canada by Professor Van Vliet in his study of the irrigation phase of the S.S.R.P.²³ More general treatments have been attempted in the United States.²⁴

²² The criterion could be defined in terms of the correlative increment in the national income or product that is attributable to the investment. Productive capacity is a "stock"; income or product is a flow. The productive capacity is merely a quantification of the correlative income flow at a point in time.

The conceptual scheme developed in the *Inter-Agency Report* is not applicable to the S.S.R.P. owing to its implied acceptance of what are essentially static assumptions with respect to the stock of resources available to the community. The relation of this point to the S.S.R.P. will be treated in this section. Professor Van Vliet cites the following as among the more important benefits:

- (a) Income benefits to irrigation producers beyond allowed cost reimbursements;
- (b) Income benefits extended to other individuals and to institutions and governments in alliance with the flow of irrigated production and income;
- (c) Savings to governments of otherwise necessary public assistance;
- (d) Benefits allied in the increase in volume and diversity of agricultural production;
- (e) Beneficial aspects of land use and conservation with respect to the irrigated and associated dry land areas;
- (f) Enhanced security and stability of production and settlement contributed to irrigated and dry land farms;
- (g) Opportunities for new settlement and re-establishment of settlement;
- (h) Possibilities of beneficial rehabilitation of existing settlement;
 - (i) Accretions of basic resources;
 - (j) Increase of rural and urban population in and around the irrigation area;
- (k) Desirable extensions of available services and facilities to individuals and groups associated in the irrigation community;
- (l) Enhancement of individual and group social amenities in the context of the irrigation community;
- (m) Favourable fiscal and employment features of irrigation investment and production.²⁵

²³ Cf. Chapter VI of *An Economic Appraisal on "Associated Contributions of Irrigation Use"*.

²⁴ Cf., for example, *Proposed Practices for Economic Analysis of River Basin Projects*. Report to the Federal Inter-Agency River Basin Committee (Washington, 1950). Referred to hereafter as *Inter-Agency Report*.

²⁵ *An Economic Appraisal*, p. 117.

These benefits may be grouped for the present purpose as follows:

- (1) Income benefits within agriculture; these are reflected in items (d), (e), (f), (g). Item (a) has been covered to a large extent in the discussion of direct benefits. Items (k) and (l) are mainly social and will be treated in a separate section of this chapter.
- (2) Income benefits outside of agriculture. This covers items (h) and (i).
- (3) Benefits to governments. This covers items (c) and (m).

Item (m) bears largely upon short-run effects which are treated in the following chapter. The effect upon government revenues will be treated here.

Item (j), the increase in population, has both economic and social implications. In its economic aspect, it falls under (1) and (2) above, and in its social aspect under the final section of this chapter. The three groups of indirect benefits cited above may be treated in order.

Secondary or Indirect Benefits within Agriculture.—Two potential types of indirect income benefits may accrue within agriculture. There are, first of all, possible secondary income benefits enjoyed by producers within the Irrigation Area in addition to the income distinguished as a direct return to the investment in the project. Then, in addition, there may be additional net incomes accruing to associated dry land producers. These latter benefits have been identified by Professor Van Vliet in the following terms:

Income benefits to dry land producers allied with various phases of integration, representing gains in terms of increased efficiencies of aggregate resource use resulting from extended complementarity of use, mainly involve the following:

- (a) Increased incomes from higher use of land and more efficient types of farming made possible by the availability of supplies, increased certainties and exchange afforded by the irrigation area;

- (b) Additional incomes from custom work, labour, rental of pasture and other services furnished to the irrigation area;
- (c) Higher incomes resulting from the superior markets for livestock and feed furnished by the irrigation area;
- (d) Savings of costs in the purchase of feed, livestock and farm produce, and other exchange with the irrigation area;
- (e) Reductions in the costs of farm and living supplies on the basis of the superior service facilities of the irrigation community.²⁶

Professor Van Vliet's conclusion with respect to the nature and magnitude of these income benefits may be quoted:

The more significant income contributions to dry-land farms in the case of the Saskatchewan Area in the nearer development period will probably be associated with narrower forms of integration such as the supply of pasture, labour and equipment services to irrigated farms and use of seasonal labour in irrigation processing and servicing establishments. These will be augmented by some further income gains or savings accruing to scattered dryland producers on the basis of various forms of exchange such as purchases of seed, feed and farm produce from the Irrigation Area and limited sales of livestock and perhaps some feed to the Irrigation Area. As suggested by experience elsewhere, some of the latter activities will be broadened and may achieve occasionally high income significance in years of more critical dry-land crop failure when opportunities for advantageous disposal of livestock, or ability to maintain breeding herds on the basis of feeds or wintering provided by the Irrigation Area, may allow significant gains to the dry-land farms directly affected. In terms of their usually narrow scope, however, they will probably afford comparatively small average income contributions over a longer period.

On the basis of the seriously limited information so far available, concerted study of features of indirect integration in terms of more nearly related experience is needed to indicate its specific and more immediate significance to the Saskatchewan Area and its potential significance in terms of long-range development.²⁷

There may also be secondary or indirect income benefits to producers in the Irrigation Area as well as to the associated dry land

²⁶ *An Economic Appraisal*, p. 127.

²⁷ *Ibid.*, pp. 131-132.

producers. There are two ways in which incomes arising within the irrigated area may represent net additions to the national income over and above the direct return to irrigation. To some extent the labour employed in the irrigation area may be immigrant labour which would not be part of the national labour force in the absence of the S.S.R.P. If this happened, the wages of this labour would not represent costs in the alternative opportunity sense and consequently would represent an addition to the national income. In other words, public investment that increases the natural resources of the country, in this case, of agricultural land, may increase the country's absorptive capacity with respect to immigration. The *Inter-Agency Report*, cited above, does not include this form of possible indirect benefit, which may be called the "productive capacity leverage effect" of investment in resource development. The *Inter-Agency Report* assumes, in effect, that the nation's stock of resources is fixed and that all the factors employed in an irrigation area would be withdrawn from alternative opportunities within the country. The incomes earned by these factors are then taken as a measure of the foregone production and treated as costs in calculating the return to the initial investment in the irrigation program.

Even if the S.S.R.P. had no effect upon the size of the labour force, there might still be an increment in the national product as a result of a more effective utilization of the agricultural labour that would shift into irrigation farming. The relatively low annual wage returns to the average farm family is a reflection of the uneconomically high ratio of labour to land in agriculture.

But there are many farm family workers who will prefer to remain in agriculture despite the compelling income differential that exists between agriculture and other sectors of the economy. A development like the S.S.R.P. would create superior alternative opportunities within agriculture for a considerable number of farm families.

By increasing the stock of agricultural land available to the agricultural labour force, the S.S.R.P. would have the effect of reducing the ratio of labour to land. Consequently, even if the numbers of agricultural workers were not affected by the project, the annual wages of some of them would be greater than they would be in the absence of the project. This improvement in annual returns, following the use of what is, in effect, unused capacity in the agricultural labour force, would constitute an increment in the national product or income of the community and therefore qualify as an indirect income benefit of the project.

Indirect Returns arising Outside of Agriculture.—The project would increase the effective stock of agricultural land resources within the country. Consequently, it would establish a land frontier, although on a relatively small scale, comparable to the agricultural frontiers of the past. In the past "the productive capacity leverage effects" associated with an agricultural frontier have had a larger impact in other fields of production than in agriculture itself. The development of the wheat economy from 1900 to 1930 had far greater implications for employment of labour and capital in the national economy outside of agriculture than for their direct employment on prairie farms. The marketing functions of assembling, storing, transporting and financing the sale of

the crop, and those involved in the supply of the consumer and producer goods absorbed on farms: all of these required agencies and implied opportunities for new capital and labour in towns and cities within the prairie region. This marketing structure was integrated with commercial, industrial, and financial plant in other parts of the country. Permanent opportunities for the employment of labour and capital were greatly increased as a result.

Gross expenditures originating in the 455,000 acres of the irrigated area of the S.S.R.P. would rise from the level of roughly \$3,000,000, associated with dry land farming, to levels of \$12,000,000 to \$16,000,000.²⁸ The spending of this money would create new market opportunities to be exploited by other producers within the region and across the country. Much of the impact of these expenditures would be diffused over a large variety of enterprises throughout the country. In many instances the impact would add to national income through its implications for unused capacity. At the same time, new opportunities for the employment of resources would arise, particularly at the local level in the fields of service, supply and processing. This latter effect is evident in Lethbridge, Taber and other urban centres within the irrigated areas of Alberta. The effect would not be very different in kind from the effects of oil development in stimulating development in these fields.

There is another important indirect economic benefit that would arise from the S.S.R.P. Prior to 1930 national policies with respect to land, tariffs and transportation were designed to integrate the expanding prairie economy with the rest of the

country, and particularly with the central provinces of Ontario and Quebec. Throughout the period of expansion, the salutary leverage effects of the growing wheat economy were channelled to other parts of the economy. After 1930 the economic distress of the wheat economy was also transmitted to other parts of the economy. The severity of economic depression in the prairie region during the decade of the 30's was in part the product of economic forces, but also, to a considerable extent, of drought, and, because of the economic integration developed before 1930, its impact was national as well as regional. The S.S.R.P. is one of a series of developments initiated by the P.F.R.A. and designed to reduce the instability, both regionally and nationally, that originates from drought.

In connection with the achievement of greater stability within the framework of the national economy there will be local benefits of a considerable magnitude. Saskatchewan has been a region of declining population in recent years. A project like the S.S.R.P. may have beneficial effects in such a region that could not be expected in a stable or expanding region. This characteristic of the locality is a factor because of the possibility of avoiding some of the losses that accompany economic obsolescence. That is, there are economic costs in regions of declining population as well as social costs and if these costs could be avoided, the gain would be an indirect benefit of the project. Irrigation farming will require much specialized plant and equipment, but a great deal of the capital equipment that was developed in dry land farming communities will be appropriate to the urban centres in the irrigation area.

²⁸ *An Economic Appraisal*, p. 136.

Indirect Benefits to Governments.—It is anticipated that a considerable benefit will be realized in the reduction of P.F.A.A. payments and of relief payments in the areas affected by the S.S.R.P. According to the P.F.R.A.:

Within the proposed development area, over the past two decades, direct agricultural assistance in form of relief in the thirties and Prairie Farm Assistance beginning in 1939, have averaged yearly approximately \$180 per farm A few townships have received Prairie Farm Assistance payments nine years out of the ten the Act has been operative. The assistance per annum for the ten years in the immediate area to be provided with irrigation facilities (where 1,245 dry land farms are located) may be estimated at $1,245 \times 180 = \$224,100$ It might be assumed that out of the 1,455 additional farmers who could be satisfactorily accommodated, 800 would have been operators of sub-marginal and marginal dry land units to the south and west . . . In their former location they would have been receiving an aggregate of at least $800 \times 180 = \$144,000$ per annum. Rehabilitated in the proposed irrigation areas of Central Saskatchewan, it would be expected that $(1,245 + 800) 2,045$ former dry land farmers would no longer require these forms of State assistance, and at past rates of payment would effect an annual savings in that item of roughly $224,100 + 144,000 = \$368,100$. This sum should be considered as partially offsetting the costs of the irrigation development.

The foregoing calculation of probable direct savings in relief assistance leaves out of consideration savings which may be effected by those of the other problem dry land areas, who will remain behind on the removal of the suggested 800 settlers, being given an opportunity to adjust their operations to a larger and more economic and self-supporting unit to meet the conditions under which it can be farmed, without continuing direct state assistance.²⁹

Another field of benefits that would accrue to the project is the possible increase in government revenue from the enhanced production. The increase in national revenue has been estimated at \$800,000 by the P.F.R.A.,³⁰ and at \$1,100,000 by the Government of Saskatchewan.³¹ These estimates are calculated as a percentage of the

increased production that is expected to result from the project. Furthermore, a calculation of the increase in tax revenues should take into account any increase in government expenditures, other than capital expenditures, that might accompany the development of the project. Ideally, the gain in tax revenues should be calculated as some percentage of the total increment in the national income resulting from the investment.

An important qualification should be borne in mind with respect to the benefits to governments. There would be no net gain in government revenues if the investment in the project precluded an alternative investment which would yield an equal total increment in the national product; that is, direct plus indirect returns, and ignoring possible differences in the distribution of the increment in national income. There would be a net gain only if the S.S.R.P. involved either (a) a larger increment in income, or (b) the same increment in income but lower government expenditures, or (c) a smaller increment in income, but a more than offsetting saving in concomitant expenditures.

Finally, it should be observed that if a percentage of the increased production goes to the national revenue, it must be subtracted from private revenue. The transfer to government results in a net gain in welfare only when the use the government makes of the income contributes more to the national welfare than the contribution made if the income had remained in the hands of the potential taxpayer. This result is not assured under all conditions and with all governments.

²⁹ P.F.R.A., *South Saskatchewan River Project, Summary Report* (Ottawa, 1951), pp. 24-25.

³⁰ *Ibid.*, p. 34.

³¹ Government of Saskatchewan, *Interim Statement* (Regina, 1952), p. 47.

Some Aspects of the Social Benefits of the S.S.R.P.—The major social benefits of the project would arise with the creation of an economic framework conducive to a growing population in an area where economic forces are compelling a decline in population. The trend to larger land units in the production of wheat has been evident since the beginning of the century. It reflects a continuous process of reorganization in the highly competitive agricultural production of the prairie region imposed by a dynamic technology.

This trend has been in evidence since 1914, although until 1930 it was more than offset by the extension of agricultural production into new territories, and during the thirties themselves the movement was held back by unemployment in other industries and, in particular, in the urban centres toward which the flow of labour normally directed itself. With the decline of urban unemployment at the end of the thirties, the movement of labour out of agriculture began on a large scale despite the relative prosperity of the wheat economy that accompanied the recovery in farm markets and the return of favourable climatic conditions. The farm population entered a stage of absolute decline with this acceleration in the process of substituting capital for labour in the prairie region.

As a result of this situation and as a result, furthermore, of the improvements in the automobile and in road construction, hundreds of small market centres that had developed in the period of expansion were faced with a large scale decline of demand, with a concomitant deterioration as communities which had consequences not only for the organization of their immediate community life but also for the rural areas

tributary to them. In the rural areas themselves, the decline of the population in numbers, the decrease in the number of farmsteads, and the rising age levels of the farm families, meant the depopulation of schools and churches and other rural organizations, and increasing isolations for farm families remaining on the farm.

The continuous reorganization of agricultural production and its impact upon the dependent economic agencies are products of powerful economic forces. On economic criteria, the changes are desirable and necessary since they result in greater economic efficiency in the wheat economy. However, the changes imposed by economic circumstances are inevitably painful for many of the individuals involved. The economic aspects of farming in Western Canada are closely bound up with the home and family life. All members of the family contribute labour to the enterprise and draw their sustenance from the joint product. In this environment a reluctance to forsake the agricultural way of life very frequently develops. If only the younger people were compelled to leave agriculture, the social costs could perhaps be easily borne; but the low level of the average farm family income implies that many of the older generation should also leave and for them the social cost involved is particularly great. Similar social costs are borne by members of the market communities in the areas of declining population, but their movement does not so often imply a change in occupation as well as in residence.

In addition to providing opportunities in agriculture for some 1,500 families, the S.S.R.P., in common with other irrigation projects, would provide the basis for the

closer community life which is disappearing over much of the rural area affected. Within that area, the social problems, with respect to community services, utilities, and home surroundings that are characteristics of rural communities experiencing population decline, would be overcome. The enhancement of individual and group amenities would be enjoyed by the inhabitants of the market centres in the region as well as by the members of the farm families involved.

In the *Summary Report* of the P.F.R.A. the importance of the social benefits that would accompany a project like the S.S.R.P. is recognized in the following terms:

At the end, but possibly the most important benefits to be derived from the irrigation development envisaged, are the home and living amenities associated with an irrigation farming community. With water on a dry land plain are given the opportunity and encouragement of working miracles in the landscaping and beautifying of the home surroundings. The garden can be counted upon to provide more and a greater variety to the family living. There are certain utilities and home conveniences, such as electricity, which are more readily obtainable in a more closely settled community associated with irrigation farming than with the more extensive dry land type, not to mention an assured supply of water at usually less cost. Then, there are other community services—business, education and social,—as well as roads made possible at lower cost for the number served by the more compact settlements with an intensive type of agriculture.³²

Finally, there are the recreational benefits that would accompany the project. A summary statement of these benefits, based on the special study of the recreational aspects of the S.S.R.P. prepared by J. A. Boan, may be quoted:

The South Saskatchewan River project is unique in the magnitude of the recreation benefits to be

expected. It not only will provide a reservoir with a shore line of almost 500 miles in length, but as well will restore Last Mountain and Little Manitou Lakes and stabilize the lakes in the Qu'Appelle Valley. As a result, at least two-thirds of the people of the province will be within a two-hour auto journey of a large body of water created or improved by this project. For the first time, for many people, there will be an opportunity to enjoy outdoor recreation on a grand scale, and for everyone there will be new facilities for hunting, fishing, swimming, boating, picnicking and camping.

The reservoir is expected to produce the fish normally inhabiting the Saskatchewan River, especially pike, pickerel and gold-eye; and the improved water level in the lakes beneficially affected should increase considerably fish populations there. Bird populations would grow, particularly migratory birds, because of the surface water available consequent upon irrigation practices. The irrigation areas would most probably encourage pheasant propagation. This, at least, has been the experience in the irrigation districts in Alberta and in the Dakotas.

Because of the intangible nature of recreation benefits they are incapable of expression in monetary terms. Yet they are real and tremendously important. An estimate of the value of the water is therefore put forward, based on one United States experience. In this case a per-acre value is placed on the water surface; and the State pays the developing agency such a sum annually in recognition of the recreational resources created. Scaled down to suit a less densely populated area, the comparable annual payment amounting to \$90,000 a year might be realized here. Such a "water rental" would find justification in the great recreation benefits, of an intangible nature, that are provided. Not only would the project increase the tourist trade, it would add qualitatively to living in an area almost devoid of natural trees, lakes and streams and good sites for parks. In providing basic facilities for outdoor recreation, the countless human benefits that are possible include better health, educational and aesthetic opportunities, and countless factors needed for better and fuller living.³³

³² *Op. Cit.*, p. 25.

³³ *Op. Cit.*, pp. 30-31.

Appendix

FARM BUDGET SUMMARIES FOR RESPECTIVE TYPES OF FARMS, NORMAL FARM SIZE AND DEVELOPED TYPES OF FARMING IN THE TRANSITIONAL PERIOD (YEAR 20) 1921-40 PRICE-COST ASSUMPTION

A: Specialty Farm

Kind	Acres	Land Use Summary				Sales		
		Acre yield	Total	Farm		Am't	Price	Value
				Seed	Feed			
							\$ cts.	\$
Irrigated area.....	100							
Wheat.....	18	27 bu.	486	27	47	412	0 86	354
Oats.....	15	41 bu.	615	30	585	.....	0 36	.....
Barley.....	7	35 bu.	245	13	225	7	0 45	3
Alfalfa hay.....	12	2 t.	24	.....	24	.....	9 45	.....
Sugar beets.....	30	12 t.	360	.....	.....	360	7 00	2,520
Pasture.....	9	.....	.....	.....	.....	.....	.....	.....
Summer-fallow.....	9	.....	.....	.....	.....	.....	.....	.....
Dryland Area.....	20							
Wheat.....	6	12 bu.	72	9	.....	63	0 86	54
Summer-fallow.....	4	.....	.....	.....	.....	.....	.....	.....
Waste pasture.....	10	.....	.....	.....	.....	.....	.....	.....
Total farm area.....	120	.....	.....	.....	.....	.....	.....	2,931

Kind	Livestock Summary					Investments ⁽²⁾
	Ave. No.	Farm used	No.	Sales ⁽¹⁾		
				Price	Value	
Horses.....	2					Buildings \$4,700 Machinery \$4,490
Dairy cows.....	6		1	4 00	cwt. 48	
Other cattle.....	10	1	3	6 25	cwt. 225	
Sows.....	2		1	25 00	ea. 25	
Other hogs.....	20	1	18	8 00	cwt. 288	
Poultry.....	75	25	36	0 50	ea. 18	
Total.....					604	

Livestock Product Sales ⁽³⁾

Butterfat.....	630 lbs. @	\$0.26.....	\$ 164
Eggs.....	440 doz. @	0.18.....	79
Total.....			\$ 243

⁽¹⁾ Adjusted to assumed weights and grades for selected type of enterprise.

⁽²⁾ Assumed new cost for given cost level.

⁽³⁾ Allowing home use as assumed for normal farm family.

OPERATING EXPENSES

Tractor operation.....	\$ 296
Truck operation.....	90
Machinery repairs.....	139
Blacksmith, welding, etc.....	20
Small hardware.....	14
Misc. gas, oil, grease.....	5
Seed and seed treatment.....	95
Fertilizer.....	65
Weed, insect sprays.....	45
Labour and board.....	860
Custom work.....	87
Taxes.....	44
Real estate upkeep.....	60
Fire insurance.....	10
Electricity.....	45
Telephone.....	15
Livestock purchases.....	16
Feeds and supplements.....	35
Veterinary, medicines.....	20
Car allowance.....	75
Total operating expenses.....	2,036

INCOME SUMMARY

	Total	Per acre
Gross farm receipts.....	\$3,778	\$37.78
Operating expenses.....	2,036	20.36
Net operating return.....	1,742	17.42
Depreciation.....	458	4.58
Net farm income.....	1,284	12.84
Capitalization		
Improvements, equipment.....	242	2.42
Non-irrigable land.....	8	0.08
Total.....	250	2.50
Operator and irrigation and land return.....	1,034	10.34
Family living A.....	600	6.00
Return to irrigation.....	434	4.34
Operator and irrigation return.....	1,034	10.34
Family living B.....	850	8.50
Return to irrigation.....	184	1.84

B: Grain Livestock Farm

Kind	Acres	Land Use Summary				Sales		
		Acre yield	Total	Farm	Used	Am't	Price	Value
				Seed	Feed			
Irrigated area.....	140						\$ cts.	\$
Wheat.....	54	27 bu.	1,458	81	80	1,297	0 86	1,115
Oats.....	18	41 bu.	738	36	615	87	0 36	31
Barley.....	16	35 bu.	560	28	488	44	0 45	20
Alfalfa hay.....	20	2 t.	40		40			
Pasture.....	10							
Summer-fallow.....	22							
Dryland area.....	260							
Wheat.....	25	12	300	33		267	0 86	230
Summer-fallow.....	15							
Waste pasture.....	220							
Total farm area.....	400							1,396

Kind	Livestock Summary					Investments ⁽²⁾
	Ave. No.	Farm used	No.	Sales ⁽¹⁾		
				Price	Value	
Horses.....	2					Buildings \$4,875 Machinery \$4,303
Beef cows.....	17		2	4 00	cwt. 96	
Other cattle.....	31	1	12½	6 75	cwt. 1,055	
Sows.....	2		1	25 00	ea. 25	
Other Hogs.....	14	1	12	8 00	cwt. 192	
Poultry.....	125		80	0 50	ea. 40	
Total.....					1,408	

Livestock Product Sales ⁽³⁾

Eggs.....900 doz. @ \$0.18..... \$ 162

⁽¹⁾ Adjusted to assumed weights and grades for selected type of enterprise.

⁽²⁾ Assumed new cost for given cost level.

⁽³⁾ Allowing home use as assumed for normal farm family.

OPERATING EXPENSES

Tractor operation.....	\$ 244
Truck operation.....	105
Machinery repairs.....	142
Blacksmith, welding, etc.....	20
Small hardware.....	10
Misc. gas, oil, grease.....	5
Seed and seed treatment.....	14
Fertilizer.....	30
Weed, insect sprays.....	30
Labour and board.....	250
Taxes.....	83
Real estate upkeep.....	62
Fire insurance.....	10
Electricity.....	45
Telephone.....	15
Livestock purchases.....	26
Feeds and supplements.....	30
Veterinary, medicines.....	20
Car allowance.....	75
Total operating expenses.....	1,196

INCOME SUMMARY

	Total	Per acre
Gross farm receipts.....	\$2,966	\$21.19
Operating expenses.....	1,196	8.54
Net operating return.....	1,770	12.65
Depreciation.....	460	3.29
Net farm income.....	1,310	9.36
Capitalization		
Improvements, equipment.....	255	1.82
Non-irrigable land.....	48	0.34
Total.....	303	2.16
Operator and irrigation return.....	1,007	7.20
Family living A.....	600	4.29
Return to irrigation.....	407	2.91
Operator and irrigation return.....	1,007	7.20
Family living B.....	850	6.07
Return to irrigation.....	157	1.13

C: Grain Farm

Kind	Acres	Land Use Summary				Sales		
		Acre yield	Total	Farm	Used	Am't	Price	Value
				Seed	Feed			
Irrigated area.....	180						\$ cts.	\$
Wheat.....	94	27 bu.	2,538	141	63	2,334	0 86	2,007
Oats.....	20	41 bu.	820	40	480	300	0 36	108
Barley.....	11	35 bu.	385	19	330	36	0 45	16
Alfalfa hay.....	20	2 t.	40		25	15	9 25	139
Pasture.....	5							
Summer-fallow.....	30							
Dryland area.....	100							
Wheat.....	34	12 bu.	408	43		365	0 86	314
Summer-fallow.....	21							
Pasture.....	45							
Total farm area.....	280							2,584

Kind	Livestock Summary					Investments ⁽²⁾
	Ave. No.	Farm used	No.	Sales ⁽¹⁾		
				Price	Value	
Horses.....	2					Buildings \$4,650 Machinery \$6,070
Beef cows.....	4		5	4 00	cwt. 24	
Other cattle.....	7	1	2	6 50	cwt. 156	
Feeders.....	6		6	6 50	cwt. 448	
Sows.....	2		1	25 00	ea. 25	
Other hogs.....	14	1	12	8 00	cwt. 192	
Poultry.....	100		56	0 50	ea. 28	
Total.....					873	

Livestock Product Sales ⁽³⁾

Butterfat.....	210 lbs.	@ \$0.26	\$ 55
Eggs.....	667 doz.	@ 0.18	120
Total.....			\$ 175

⁽¹⁾ Adjusted to assumed weights and grades for selected type of enterprise.⁽²⁾ Assumed new cost for given cost level.⁽³⁾ Allowing home use as assumed for normal farm family.

OPERATING EXPENSES

Tractor operation.....	\$ 255
Truck operation.....	120
Machinery repairs.....	196
Blacksmith, welding, etc.....	20
Small hardware.....	10
Misc. gas, oil, grease.....	5
Seed and seed treatment.....	10
Fertilizer.....	65
Weed, insect sprays.....	40
Labour and board.....	310
Taxes.....	94
Real estate upkeep.....	56
Fire insurance.....	10
Electricity.....	45
Telephone.....	15
Livestock purchases.....	266
Feeds and supplements.....	25
Veterinary, medicines.....	15
Car allowance.....	100
Total operating expenses.....	1,657

INCOME SUMMARY

	Total	Per acre
Gross farm receipts.....	\$3,632	\$20.18
Operating expenses.....	1,657	9.21
Net operating return.....	1,975	10.97
Depreciation ⁽¹⁾	562	3.12
Net farm income.....	1,413	7.85
Capitalization		
Improvements, equipment ⁽²⁾	274	1.52
Non-irrigable land ⁽³⁾	40	0.22
Total.....	314	1.74
Operator and irrigation return.....	1,099	6.11
Family living A.....	600	3.33
Return to irrigation.....	499	2.78
Operator and irrigation return.....	1,099	6.11
Family living B.....	850	4.72
Return to irrigation.....	249	1.39

⁽¹⁾ Calculated on buildings, fences, wells and equipment, rates adjusted for types and comparative efficiencies.⁽²⁾ Based on one-half of assumed new cost of buildings, fences, wells and equipment at 5 per cent.⁽³⁾ Interest at 5 per cent on assessed value of land.

Immediate Impact On the Economy

CHAPTER 9

Short-Run Effects of South Saskatchewan River Project

THIS chapter considers the nature of the South Saskatchewan River Project to determine, as far as possible, the character and size of the immediate effects of its construction upon the economy. An appreciation of the *real* cost of the project can only be achieved through study of these effects. These effects depend on the nature of the project, but also upon the economic conditions prevailing throughout the period of construction. For this reason, the timing of construction and the extent of possible variations in the rate of construction during the construction period have a bearing on the cost and, since the end in view is to maximize the benefits from the project, must be taken into account.

General Considerations in the Cost of the South Saskatchewan River Project

As a public investment project, the S.S.R.P. must be considered within the general framework of current and prospective levels of public and private investment. The previous chapter emphasized the long-run effects of the S.S.R.P., identifying these effects as the yield or return from the project to the Canadian people. Variation within a

short period of years in the timing of the construction of the project would have only a modest effect upon the magnitude of the yield or return from the project in view of the long lag between initiation and maturity and the nature of the time horizon in which the yield of the mature project would accrue. However, a variation in timing within the same limits could have a substantial effect upon the *real* cost of the project. Hitherto the cost of the S.S.R.P. has been expressed as the sum of money costs of construction measured in current prices. This expression of cost is inadequate. It is the purpose of the present chapter to examine at some length the broader concept of *real* cost and its implications for the project.

The economic resources of Canada have been fully employed in recent years. Gross investment has accounted for more than 20 per cent of the gross national expenditure on finished goods and services. This demand for investment goods implies a substantial diversion of labour and other economic resources into the production of investment goods. The remainder of the resources have been employed, either directly or indirectly, in production of goods and services for consumers and of goods, other than capital

goods, and services for governments. It is apparent that, in addition to the long-run production or income effects dealt with in the previous chapter, investment contributes in the short-run to current employment of a large proportion of the labour and other economic resources of the country. The employment of these resources in the production of investment goods is the real cost of investment to the community. The community, in effect, foregoes current consumption to the extent that labour and other resources, which might have produced consumer goods, are employed instead in the production of investment goods which will increase the flow of consumption goods in the future.¹

In this context, the real cost of any specific project is the foregone alternative, the other thing or things that the resources absorbed in the project would have produced. If the resources involved have no alternative, there is no real cost. If, at the time of construction of the S.S.R.P., some part of the required labour were unemployed, if unused capacity existed in domestic plants producing needed equipment and materials, or if some portion of the raw materials absorbed had no other present or future use, the real cost would be accordingly reduced. The project would compete only with alternative public projects which required the same resources.

¹ It is in this peculiar sense that economists frequently define the term "saving". As indicated above, "saving" means that consumers are deprived of certain goods and services that they might otherwise have enjoyed, in order that the output of investment goods may be increased. Sums of money saved from current income are spent to buy materials and labour services for various types of construction, the production of machinery and equipment, and for the accumulation of inventories. These sums may be spent by private entrepreneurs who acquire them through the bond market or otherwise, or they may be spent by governments,

Moreover, under such circumstances, receipts of benefits need not be limited to the ones specifically to be attributed to the project itself. If there are unused labour, unused capacity in domestic plants, and unused raw materials available to the S.S.R.P., it would be most probable that there would be other slacks in the economy. The spending of incomes earned from the project would generate secondary income and employment in other industries and to some degree at least take up these slacks.

An inverse consideration in the cost of public projects (and one which is currently relevant to the S.S.R.P.) arises under conditions where the economy is already at the level of full employment and suffering from inflationary pressures. Inflation brings burdens to some and benefits to others which must be taken into account before a decision can be made, for or against, the initiation of a new project. Inflation tends to redistribute both the real income and the claims to the real wealth of the community in a manner which may have little or no relation either to justice or to the economic efficiencies of those who lose and those who gain. If, of course, the incidence of the effects can be reliably ascertained, and if they can be offset effectively by fiscal or other means, such possibilities may be elements to be considered when choices are being made among alter-

which acquire them by borrowing from the savers. Government investment may also be financed through taxation. When the flows of funds for privately financed investment are exactly equal to the demands for them at current rates of interest, and when the costs of publicly financed investment are fully covered by current taxation and/or current borrowing from private savings, then the economy is in a state of balance, and it is free from the threat of both inflation and deflation. The result of carrying out plans for public and private investment on a larger scale than this, is inflation; on a smaller scale, it is deflation.

native lines of action. But the possibility of redressing, through taxation and transfer payments, the adverse effects of inflation may be quite beyond the rather rough instruments of fiscal policy. The facts respecting the effects to be counterbalanced may not be evident until some time after their occasions have passed by. Although it is very difficult indeed to evaluate in money terms the effects of a new project upon the national economic welfare, some allowance must be made for them in the reckoning of costs for a public project where it is likely to create, or to enlarge, inflationary pressures on the economy.

It is for such reasons that in recent years, and particularly since mid-1950, it has been the policy of the federal government to postpone public construction projects that can be deferred on the grounds that the current high level of investment demand is an important factor in the prevailing inflation and that public investment adds to the pressure upon the price level. If the specific economic resources required to meet any net increase in government expenditures are already employed in some other use, the increase in the expenditures will tend to raise prices. So again, on this account, it is necessary to consider the present and possible future status of the specific resources required in the construction of the S.S.R.P.

Methods of Financing the S.S.R.P.²

With respect to financing the project, the government of the day would presumably make annual appropriations to the project as its construction was carried out. These

might be made under the ordinary budgetary expenditures of the department concerned. Alternatively, a special government corporation might be created, as in the case of the St. Lawrence Seaway project. Accounts under such a proceeding would be set up separately from the budget accounts and the annual advances made to the S.S.R.P. would be entered under non-budgetary disbursements of the government. Under the first procedure, the budgetary surplus of the government would be decreased (or the deficit increased) by the expenditure; under the second procedure, the budgetary surplus (or deficit) would not be affected. But this is a matter only of bookkeeping. The cash surplus, as distinct from the budgetary surplus, would be affected in exactly the same manner and to the same degree by an annual advance of a given size.

The alternatives conditioning the real cost of the project to the nation may be viewed in terms of the effects upon the national budget and the national disbursements, or non-budgeting items. If economic conditions are so inflationary, or so nearly inflationary, that the government of the day feels its expenditures cannot be increased, the nature of the projects curtailed or sacrificed in order to include the S.S.R.P. would be a measure of the real cost of the project. The cash surplus would not be affected.

If, on the other hand, budgetary or non-budgetary expenditures of the government are increased by the full size of annual disbursements to the S.S.R.P. under the same economic conditions, then either the cash surplus of the government is decreased or an actual deficit incurred. We may disregard

² This note on finance was prepared for the Commission by Dr. M. F. Timlin, University of Saskatchewan.

here the possible uses of the cash surplus impounded in the chartered banks or Bank of Canada as a counter-inflationary weapon and concentrate instead on the two alternatives of repayment of part of the public debt, or the necessity to resort to deficit financing.

If the amounts required for the annual appropriations for the project were to be used instead to redeem part of the public debt, before we could know its real cost, we should need to know the uses to which the recipients of funds would put the money received. If these had greater economic importance than the S.S.R.P., the real costs of the project would be too high to warrant its execution under such conditions. On the other hand, the possibility also enters that taxes might be cut to an equivalent amount and the real costs would then be determined by the sacrifices of taxpayers.

If the issue is that the government must borrow, then the effects or real cost would depend upon the places where the government goes to get its funds. If the government goes to the banking system under the economic conditions postulated above, then the effects will be to add to inflationary pressures, unless some other offsetting element is operating. If it goes to the Bank of Canada, the inflationary effects may be exaggerated through effects on the reserve ratios of the chartered banks. But even if the government goes to the bond market and sells bonds there, there is no certainty that the effects would not be inflationary. If the public to some degree regards the bonds purchased as an adequate substitute for savings balances in the banks, the funds loaned to the government and expended for the S.S.R.P. may be transferred from the

inactive to the active accounts *via* this spending without offsetting transfers sufficient to rebuild the idle balances. The active circulation will be thereby enlarged.

Even taxing, to keep government revenues equal to expenditures, may have the same effect. It may result in some reduction of saving rather than in an exactly offsetting reduction of consumption spending. Consumption may be maintained in the first instance by a rate of flow of goods from retail and wholesale establishments which depletes inventories; this is disinvestment. After that, increased competition for consumption goods, in relation to supplies coming forward, will tend to increase their prices.

The crux of the matter is that there must be consistency between *planned investment* (private and public) and *planned saving* (voluntary and involuntary). A project of the nature of the S.S.R.P. can be *added* and stability can still be attained in the price structure, if the government is able to *induce* the extra saving either by the terms it offers lenders (voluntary saving) or by taxing in such a way that it actually reduces consumption (involuntary saving) by as much as investment is increased (growth and certain other factors in the economy being ignored here).

In the National Accounts, saving is always equal to investment. But these National Accounts make their reckoning after the *process* by which this equality is achieved is a matter of history. *Plans* for investment are made ahead of this process, and they may be quite inconsistent with plans for consumption and saving. If planned investment is in excess of planned saving, competition

for consumers' goods will enhance business profits, and enlarge business saving. In the first instance, consumers may, by an unexpected enlargement of their demands on retailers, diminish inventories and thus *disinvest* a portion of the accumulated stocks of the community. The ordinary reaction of retailers to this enhancement of demand is to raise prices. By this process their revenues are enlarged. If they attempt to rebuild the inventories by enlarging their own demands on their sources of supply, they may find themselves compelled to pass back a portion of the increase in revenue to meet increased prices for inventory replacements. But aggregate business profits throughout will be increased by the unexpected increases in revenues from sales.

If business firms themselves are attempting to make speculative increases in inventories over the same period, these effects may be exaggerated. If, for example, retailers and wholesalers are attempting to *increase* inventories in the face of unexpectedly large sales, they may increase demands on their own sources to an even greater extent through the use of funds derived from inactive working capital or from an expansion of bank borrowing. Competition will tend to raise the prices of the goods they purchase and to enlarge business profits of the firms from which they buy. Business savings will tend to be increased over and above the increase in consumers' expenditures, to parallel the increased inventory investments of other business units.

In the end, saving and investment will be equal to each other in the National Accounts. But the equality will have been brought about through rising prices and through

transfers of claims to real income and wealth which may have very little to do with economic efficiency or real cost. They may in fact be determined as much by the relative degrees of monopoly characterizing supply sources as by genuine incapacity in these to adjust supplies to the increasing demands with the required speed. In a period of full employment, the equality between saving and investment is brought about through the price system, and the inequities of inflation are no less real because it can be demonstrated that saving equals investment in the National Accounts.

The year 1950 provides examples of this process. Consumers in this year, impelled probably by fears of shortages connected with the outbreak of the Korean war, spent a larger proportion of their disposable personal income than had been the case in the immediately preceding years. The result was a rise in consumers' prices. Similar expectations at the retailers' and wholesalers' levels impelled business firms to attempt to *increase* their inventories in spite of the increased sales. The total effect (taken with increased defence spending) was an increased pressure on sources of supply and rising prices at anterior stages in the production process, supported by an increase in currency and active bank deposits. The equality between saving and investment was brought about through the price system. That year in Canada, the National Accounts show nearly 60 per cent of gross capital investment to have been based on gross business saving. But the process of inflation lowered the real values of incomes and assets fixed in terms of money, and increased equity

rights, without reference to economic deserts. An increase in defence spending was one of the important elements in this situation. But similar effects can be connected with any increase in public or private investment above the level of planned savings when it is imposed on an economy where all the agents of production are already fully employed.

It would be possible to follow the same process, with the necessary changes, through a situation in which planned investment was assumed to be deficient, or alternatively, where planned savings were assumed to be excessive. The real cost could be shown to be *less* than the accounting costs of the project. If the alternative to the use of labour, equipment, and materials on the S.S.R.P. would be that they would otherwise remain to some degree *unused*, even though the project involved the government in deficit financing, the real costs of the project would be less than the accounting costs.

The essential point of the preceding paragraphs is that it is necessary to examine public projects like the S.S.R.P. with respect to the otherwise existing situation to ascertain probable economic effects. Timing of the project is a matter of the utmost importance. The project may be timed so as to support the level of national income and employment. But it may also be timed in such a way that it induces or exaggerates inflation. There are moral as well as economic aspects connected with the use of the tax system and public investment to take real income and assets from one group of persons to give them to other groups.

Prospective Annual Outlays on the S.S.R.P.

The total cost of the S.S.R.P. in current prices has been estimated at \$247,500,000. From the point of view of its immediate effects, the relevant consideration is not the total cost, but the annual outlay relative to total investment of the same character within the economy and, particularly, within the prairie region itself. The construction period cannot be forecasted precisely. However, for the purpose of illustration it will be assumed that the construction plan set forth in the P.F.R.A. Engineering Report would be followed.

The three major components of the project, their respective costs, and the assumed construction periods for each are shown in the following table:

—	Cost	Construction Period
	\$	
Dam and Reservoir...	139,800,000	8 years beginning Year 1
Power Plant.....	24,000,000	2 years beginning Year 7
Irrigation System (not including pumping stations)	45,000,000	20 years beginning Years 5 and 6

On the basis of this plan, average annual expenditure would run at about \$17,500,000 a year, from Year 1 to Year 5, rise to about \$20,000,000 in Year 6 when the irrigation structures were begun, and to about \$32,000,000 in Years 7 and 8 with the installation of power plant and equipment. In Year 9 the annual outlay would then drop to about \$3,000,000 and vary thereafter between \$400,000 and \$2,800,000.

While it is desirable to begin using water for irrigation as soon as possible, it is also desirable not to flood the market with irrigated land. This implies beginning the irrigation structures in Year 6 and developing the system over a period sufficiently long, perhaps 15 to 20 years, to bring the new land into the market at a reasonable rate. However, the whole construction process could be accelerated if prevailing conditions warranted.

The large outlays of Years 7 and 8 could be reduced by prolonging the final stages in the construction of the dam and reservoir and reducing the rate of construction of the power plant and the initial irrigation structures. Outlays in the other years could be similarly reduced.

One critical stage in construction, the closure of the river, when a rigid minimum of work would have to be done, establishes the minimum peak expenditure. The year of river closure is not fixed. The closure operations could begin on August 1, in either of the 4th, 5th or 6th Years and, once the commitment had been made, continue to June 1st of the following Year. Assuming that other operations continued at their normal pace, outlays of about \$17,500,000 would be made in the two years affected by closure. Suspension of other operations would allow a large reduction in total outlays at this juncture. On a rough estimate, the cost of the more expensive method of closure proposed would not exceed \$7,500,000.

Annual Outlays Compared with Investment in Canada and in the Prairie Region.—On the basis of the foregoing discussion, it may be concluded that so long as market

conditions did not imply variation in the rate of construction, the annual outlay in the S.S.R.P. would rise from about \$17,500,000 in the 1st Year, to \$32,000,000 in the 7th and 8th Years and then fall below \$3,000,000.

Investment outlays of this order appear small in comparison with recent levels of investment in Canada. In 1951, new investment in durable physical assets, that is, construction plus machinery and equipment, was \$4,581 million. Government departments accounted for \$584 million of this total. New investment in the prairie region was almost a billion dollars in 1951 and Government departments spent \$124 million of the total of \$956 million. The following table indicates the level of this type of investment in recent years.

TABLE I
Direct Government and other New Investment in Durable Physical Assets, Canada and Prairie Provinces, 1948-1951

(Millions of Dollars)

Year	Canada			Prairie Provinces		
	Direct Gov't	Other	Total	Direct Gov't	Other	Total
1948	394	2,781	3,175	90	546	636
1949	407	3,094	3,501	97	666	763
1950	446	3,369	3,815	99	753	852
1951	584	3,997	4,581	124	832	956

Source: Economics Division, Department of Trade and Commerce, Ottawa.

The S.S.R.P. is a public engineering project and may appropriately be compared

with new construction as a whole and engineering construction in particular, in Canada and the Prairie Provinces. In view of the high degree of regional and occupational immobility characteristic of the labour force in the short run, a comparison of annual expenditures on the S.S.R.P. with total engineering construction in the prairie regions is probably of most significance.

In 1951 the investment in new structures of all kinds was \$2,688 million; Government departments alone spent \$517 million on new construction, of which \$370 million was for engineering construction. Total engineering construction, public and private, was \$860 million.

New construction in the Prairie Provinces was valued at \$499 million in 1951. Of this total, \$196 million was spent on engineering construction of all types. Direct government expenditures on engineering construction in the prairie region were \$83 million.

Over the past four years just under 20 per cent of total construction in Canada was undertaken in the prairie provinces. Roughly the same regional distribution held with respect to engineering construction prior to 1950. Beginning in 1950 there has been both an absolute and a relative increase in engineering construction in the Prairie region. In 1950, twenty-five per cent, and in 1951, 23 per cent of the national total of engineering construction was undertaken in the Prairie Provinces.

The following table shows the pattern of engineering and other construction in the country as a whole, and in the Prairie Provinces from 1948 to 1951.

TABLE II

*1. New Construction in Canada and the Prairie Region
1948-1951*

(Millions of Dollars)

Year	Canada			Prairies		
	Direct Gov't	Other	Total	Direct Gov't	Other	Total
1948	314	1,563	1,877	75	272	347
1949	338	1,786	2,124	80	341	421
1950	398	1,968	2,366	87	382	469
1951	517	2,171	2,688	107	392	499

2. New Engineering Construction in Canada and the Prairie Region, 1948-1951

(Millions of Dollars)

Year	Canada			Prairies		
	Direct Gov't	Other	Total	Direct Gov't	Other	Total
1948	252	325	577	58	51	109
1949	262	379	641	60	76	136
1950	318	446	764	71	122	193
1951	370	490	860	83	113	196

Source: Economics Division, Department of Trade and Commerce, Ottawa.

**The Economic Resources
Required by the S.S.R.P.**

Money outlays of the order of \$17 to \$32 million a year do not appear large in comparison with construction activity in the country as a whole. A better perspective on the effects of the S.S.R.P. may be obtained by considering the physical resources required. The resource demands of the project may be broken down into materials, on-site labour, and machinery and equipment.

Each of these will be examined with respect to: (1) type; (2) numbers or amounts required; (3) sources of supply, and (4) the implications of the project's demands.

Materials.—The major material requirements of the S.S.R.P. are the various types of fill. A total of approximately 57,500,000 cubic yards of fill will be required: 41 million cubic yards in the main dam, conduits and spillway; and the balance in the Elbow railway crossing and the two minor dams. The fill materials are available at or near the site. Since these materials have no apparent alternative use, their use in the S.S.R.P. will involve little or no cost.

Requirements for riprap are 702,000 cubic yards. This rock may have to be brought from the Frank Slide in Alberta. There is no problem in its supply.

The project will also require about 1,000,000 cubic yards of concrete. The concrete aggregates are located at or near the site and their use involves no apparent cost. A large portion of the concrete (placed with either light or heavy reinforcement) will require about six bags of cement per cubic yard. The remaining concrete will require four bags of cement per cubic yard. The total cement demand will be approximately 6,000,000 bags.³

The cement demand is heavy in the 2nd and 3rd Years, rising from about a quarter of a million bags in Year 1 to about 2.5 million bags in Year 2, 1.6 million in Year 3 and .8 million in Year 4. Demand is small in Years 5 and 6 and about the same in Years 7 and 8 as in Year 1.

³ On the basis of present plans, about four of this six million bags of cement will be Kalicrete Cement. Contemplated studies of the potential intensity of sul-

The cement would come from Exshaw, Alberta, and from Winnipeg. Present capacity at Exshaw is 6,400,000 bags a year. This will be increased by 4,800,000 bags by the spring of 1953. The capacity at Winnipeg is 6,400,000 bags a year. There has been a considerable pressure on plant capacity in the West in recent years. The expansion at Exshaw is expected to ease the situation. If the demand of the S.S.R.P. were imposed on a total demand of the current level there should be no price effect, and, according to officials in the industry, if there were advance notice on the orders, there would be no difficulty in securing delivery of the quantities required.

There are three types of steel required; 30,580 tons of reinforcing steel, and 22,600 tons of steel plate and structural steel. Most of the latter is steel plate, of which 16,500 tons are specified for the penstocks alone. The structural steel required is of standard sizes. The bulk of the demand for reinforcing steel would fall in the first four years reflecting the concrete placement pattern. Unlike cement, the order for the reinforcing steel could be spread evenly over the first four years. This implies an annual demand of just under 8,000 tons in each of these years. Most of the structural steel would be required in Year 5 and the bulk of the plate steel in Years 7 and 8.

In terms of domestic capacity at the end of 1952, a demand for reinforcing steel of this size could be handled easily even if the present high level of demand continued. The structural steel required is a smaller item and would afford even less difficulty.

phate attack upon the large mass section of the conduits may lead to a reduction in the proportion of Kalicrete Cement required.

With respect to fabrication of both reinforcing and structural steel, plant capacity is available in the urban centres of Alberta, Saskatchewan and Manitoba.

The relation of the steel plate demand to present conditions of supply is not so favourable; steel plate is in short supply. Two mills in Hamilton produce the domestic supply of approximately 225,000 tons a year. In fabrication for penstocks, the plate must be stress relieved. The nearest domestic fabricator equipped to handle an order of this kind is in Montreal. However, since the plate is not required until the 7th and 8th Years of the construction period, the amount involved does not appear to be a major item.

There are no other material requirements of significant size. It may be concluded that the material demands of the S.S.R.P. could be met with comparative ease, even under prevailing conditions, with the possible exceptions of cement and steel plate. Most of the domestic plant affected by the material demands is in Western Canada.

Labour.—The total on-site labour requirement of the S.S.R.P. is estimated at 26,000,000 man hours. Of these 18,000,000 are required in the construction of the main dam and reservoir and the remaining 8,000,000 in the construction of the power plant and irrigation system. While the flexibility of the project should be borne in mind, it may be assumed for the present purpose that the construction of dam and reservoir would proceed at an even pace. On the basis of 125 working days a year and 10-hour shifts, the average annual labour force required in the construction of the dam and reservoir

would be 1,800 men.⁴ The average requirement would rise with the initiation of construction of the irrigation system and power plant. Most of the 8,000,000 man-hours estimated for these latter structures would be spread over the 15 to 20 years allowed for the irrigation development.

A very large proportion of the labour, at least 75 per cent and perhaps 85 per cent, would require previous experience in the types of machine operation involved. The remaining labour would be unskilled, performing operations that do not require training.

It is difficult to set a distinct geographical limit on the labour market relevant to the S.S.R.P. In general, labour would be drawn from the prairie region as a whole, including the head of the lakes, particularly during the spring movement from that territory.

The male labour force in the Prairie Provinces at August 1951, was 787,000, of whom 390,000 were engaged in agriculture, 391,000 in non-agricultural occupations, and about 6,000 were without jobs and seeking work. 361,000 of this total force were paid workers. Table III shows the industrial distribution of male paid workers at August 1951.

TABLE III
*Male Paid Workers by Industry in
Prairie Provinces*

(Thousands of persons 14 years and over)	
Agriculture and other	
Primary Industries	41.3
Manufacturing	74.1
Construction	36.3
Transportation and Public Utilities	67.3
Trade, Finance, Service, Etc.	142.1
Total	361.1

Source: Dominion Bureau of Statistics, Labour Force Survey, Ottawa.

mated at 125 for impervious fill, and 150 days for pervious fill and excavation of waste materials.

⁴ The maximum length of the construction season is 154 working days. Average of working days is esti-

There were 16,500, 6,000 and 13,700 paid construction workers in Alberta, Saskatchewan and Manitoba, respectively, or a total of 36,300 in the region as a whole. A demand for 1,800 construction workers would constitute a significant proportion of this total. However, for that part of the 1,800 that could be unskilled, there are alternative sources. There were approximately 42,000 paid workers, and 73,000 unpaid family workers on prairie farms at August, 1951. In addition, there were 249,000 own-account workers, and about 27,000 employers in agricultural occupations. Farm operators, whether own-account or employer, are not a usual source of construction labour. However, each year there are local droughts in the region, and engineering construction projects can and do tap these localities for some part of their labour supply. Labour from this source, once acquired, has a much lower turn-over than the average turn-over among workers on engineering projects.

Any movement of workers out of agriculture may also be a potential source of unskilled construction labour. On the basis of the D.B.S. Labour Force Surveys, the total farm labour force in the Prairie Provinces declined from 536,000 in 1946 to 437,000 in 1951. However, the decline was more marked among females than among males. The number of males at the period of peak activity in agriculture declined from 427,000 to 404,000 over the same period. Statistical evidence is not available at the present time to determine in which occupational groups these declines took place. It seems probable that the drop was predominately among own-account and unpaid family workers, rather than among paid workers.

There probably would be a certain amount of farm labour available for other work during the months of June and July, in between the spring and fall peaks of farm labour demand. The number probably would not be large at the present time. There continues to be a marked competition for labour between the construction industry and farming in the summer months, and the peak of the farm labour demand coincides with that of the construction industry.

Another potential source of unskilled labour is through immigration. The Federal government has brought in large numbers of workers in recent years for specific construction and farming jobs in addition to the regular flow of immigrants. In total, about 25,000 immigrants in 1951 gave their destination as the Prairie Provinces. It is estimated that at least 60 per cent of these would enter the labour force.

In general, it may be concluded that there is a potential supply of unskilled labour of sufficient size to meet the demands of the S.S.R.P. In view of the nature of supply, it is most unlikely that wage rates higher than those prevailing in construction would be necessary to attract this labour. However, if there is no slack in the labour market within the region, the attraction of this labour implies a real cost in terms of alternative production. If the alternative production for the unskilled labour required by the S.S.R.P. is in agriculture, which appears to be a reasonable assumption under present circumstances, the wages of paid workers in agriculture provide an approximate index of the real cost. On the other hand, the higher wage rate paid for unskilled labour on a project like the S.S.R.P. cannot be taken as a

measure of the benefit of the labour so employed unless it can be shown that the net productivity of labour used in the river project would be correspondingly greater than the productivity of agricultural workers. The conclusions of the previous chapter are relevant here.

The same general reasoning applies to the skilled and semi-skilled workers who make up the greater part of the labour force required. With full employment these would be drawn from other construction projects and in their case the actual wage rate paid would be an approximate index of the real cost.

There is a high level of demand for labour in the prairie region at the present time. Since the summer of 1951, when the decline in consumer demand began to affect employment levels in most other regions, the employment situation in the prairie region has been relatively more favourable than that in any other section of the country. Some of the contributing factors are:

1. The high level of industrial development, particularly in the Province of Alberta, has increased the demand for labour.
2. The volume of defence construction contracts is relatively large.
3. Many surplus workers have moved to British Columbia and the Lakehead area.
4. The high level of farm income has reduced the number of farmers seeking off-season employment.
5. The increase in population in the Prairies has been less marked than in other regions.

These demand and supply factors are reflected in the number of people seeking work through the National Employment Service. Table IV compares the employment situation in the prairie region with the four other major regions and Canada as a whole, on the basis of the National Employment Service statistics. These local labour market ratings are based on the ratio of the number of job applications to the estimated total of wage and salary workers in each local labour market area. It is apparent in Table IV that, relatively speaking, the pressure on the labour supply at the present time is much greater in the prairie region than elsewhere in the country.

TABLE IV

Local Labour Market Area Groupings, May 1, 1952.

Ratio Job Applications to all Wage and Salary Workers	Number of Areas					
	Canada	Atlantic	Quebec	Ontario	Prairies	Pacific
15% and over.....	32	9	18	3	.....	2
10—14.9%.....	26	3	17	3	1	2
5—9.9%.....	78	15	8	35	8	12
0—4.9%.....	42	.....	.....	20	20	2

Source: Economics and Research Branch, Department of Labour, Ottawa.

Table V indicates the trend of employment in 1951 and 1952 in the prairie region on the basis of the ratio of job applications to wage and salary workers. There is a total of 29 office areas (National Employment Service) in the region, which includes the Lakehead. It will be noted that the number of areas in which the ratio of job applications to number of wage and salary workers was under five per cent, was consistently larger in the first eight months of 1952 than in the corresponding months of 1951. In the

month of May 1951, for example, eleven local labour market areas were in the under-five-per cent class, while in May 1952, 20 market areas were in this class. The data of Table V demonstrate that the pressure on the labour supply, which was considerable during 1951, and particularly through the construction season, increased during 1952.

TABLE V

Local Labour Market Area Groupings, Prairie Region

Date	Distributions of Areas on Basis of Ratio of Job Applications to Number of Wage and Salary Workers				
	Over 15%	10-14.9%	5-9.9%	0-4.9%	0-4.9(a)
1951					
January 1.....			17	12	
February 1.....	1	3	17	8	
March 1.....	1	3	18	7	
April 1.....		3	19	7	
May 1.....		1	17	11	
June 1.....			2	22	5
July 1.....				23	6
August 1.....				22	7
September 1.....				21	8
October 1.....				23	6
November 1.....			1	23	5
December 1.....			3	25	1
1952					
January 1.....			13	16	
February 1.....		1	18	10	
March 1.....		2	19	8	
April 1.....		3	20	6	
May 1.....		1	8	20	
June 1.....			2	26	
July 1.....				29(b)	

(a) With marked shortage in specific occupations.

(b) Including areas with marked shortages in specific occupations.

Source: Economics and Research Branch, Department of Labour, Ottawa.

Table VI shows the recent market ratings on the basis of applications for employment to total wage and salary workers in the five urban centres nearest the site of the S.S.R.P.

None of these centres has experienced a surplus of labour; even during the winter season the ratio of application has not exceeded 10 per cent and, throughout the construction season, the ratio has been less than five per cent, with marked shortages in specific occupations prevailing for several months in Edmonton, Calgary and Moose Jaw, during 1951. It may be noted that, beginning in May 1952, the ratios were lower in 1952 than in 1951 in four of the five cities, reflecting the tighter labour situation of 1952.

TABLE VI

Labour Market Ratings of Selected Areas in the Prairie Region

	Edmonton	Calgary	Saskatoon	Moose Jaw	Regina
1951					
January.....	3	3	3	3	3
February.....	3	3	3	3	3
March.....	3	3	3	2	3
April.....	3	3	3	3	3
May.....	3	3	3	3	3
June.....	4	4	4	4	5
July.....	5	5	4	5	4
August.....	5	5	4	5	4
September.....	5	5	4	5	4
October.....	5	5	4	5	4
November.....	5	3	3	4	4
December.....	4	3	4	4	4
1952					
January.....	3	3	3	3	3
February.....	3	3	3	3	3
March.....	3	3	3	3	3
April.....	3	3	3	3	3
May.....	3	4	4	4	4
June.....	4	4	4	4	5
July.....	4	4	4	4	4

Rating: Ratio of Applicants for Employment on file with National Employment Service to all Wage and Salary Workers.

1—15 per cent and over

2—10-14.9 per cent

3— 5- 9.9 per cent

4— 0- 4.9 per cent

5— 0- 4.9 per cent—with marked shortages in specific occupations.

Source: Economics and Research Branch, Department of Labour, Ottawa.

It was pointed out above that under full employment conditions, the S.S.R.P. could probably draw some labour from the supply currently available to agriculture because of the differential in wage rates in construction and agriculture. While this is favourable from the point of view of the construction industry and implies a lower level of real cost for the project than if the labour were drawn from other construction projects, it would tend to aggravate the problem of the persistent shortage of farm labour characteristic of the region in recent years. Table VII shows the number of vacancies for farm hands registered with the National Employment Service at the end of each month since January, 1950. These data may understate the demand because not all employers register this need with the Employment Service.

TABLE VII

*Vacancies for Farm and Harvest Hands, Male
Prairie Region, 1950-1952
(as at end of each month)*

	1950	1951	1952
January	83	78	153
February	140	156	267
March	378	428	711
April	697	1,047	1,851
May	478	765	719
June	327	349	539
July	531	482	673
August	766	659	-
September	1,030	1,136	-
October	418	525	-
November	137	325	-
December	61	117	-

Source: Economics and Research Branch, Department of Labour, Ottawa.

Table VIII shows the number of areas with shortages of farm labour in the prairie region in 1951 and 1952. It will be noted that no area has reported a surplus of farm labour

in any month during this period. There is no indication in either Table that the farm labour picture is improving (as might be expected with the continuing large scale capital outlays on prairie farms). In fact, the data support the opposite view.

TABLE VIII

Number of Areas with Farm Labour Shortages and/or Surpluses in Prairie Region, 1951 and 1952

Date	Farm Surplus	Hands Shortage
1951 March		
April	-	1
May	-	6
June	-	10
July	-	3
August	-	6
September	-	8
October	-	10
November	-	3
December	-	1
1952 January	-	-
February	-	-
March	-	-
April	-	6
May	-	12
June	-	6
July	-	4

Source: Economics and Research Branch, Department of Labour, Ottawa.

On the basis of this survey of the labour market in the prairie region, it may be concluded that labour is in short supply at the present time and particularly during the construction season. If the S.S.R.P. were initiated under conditions like those prevailing in 1952, the demand for labour of the types and in the amounts required would add to the pressure on the labour markets affected.

A considerable part of the labour required would have an alternative employment opportunity on farms at lower wage rates than are paid in construction. While there would be a tendency for farm wages to rise

with an increased shortage of farm labour, the wage effect would probably be negligible in view of the relatively small number of workers involved. With no appreciable wage effect, the real cost of the labour drawn from construction and agriculture would be indicated by the respective wage rates prevailing there. In the absence of unemployment, any labour drawn from local drought regions would also involve a real cost in this sense.

If the foregoing analysis is correct, a major part of the real cost of the initiation of the S.S.R.P. in a period of labour shortage is reflected in the total wage bill adjusted for the proportion of labour drawn from agriculture and the difference in the wage rates. Immediately any easing of the labour supply occurs and to the extent that the employed labour has no alternative employment opportunity, the real cost will be reduced accordingly. The important point in this conclusion is that the real cost of the S.S.R.P. is variable. If it were constructed under conditions like those described above, the real cost would approach its maximum. But, if conditions in the labour market began to ease, then, immediately and to the extent that surpluses of the relevant labour appeared, the real cost would be reduced.

Machinery and Equipment.—Construction firms engaged in earth moving projects are among the most mechanized enterprises in the construction field. The firm, or firms, with whom contracts on the dam and reservoir are made, will require a considerable quantity of large-scale, modern machinery and equipment. The timing and quantity of these equipment demands will be considered in this section.

If the construction program set forth above were followed, annual expenditure on the dam and reservoir would run at about \$17·5 million a year. According to estimates from the files of the Section on Public Projects, Department of Reconstruction and Supply, equipment rentals on the South Saskatchewan Project would be approximately 43 per cent of the total cost of the project exclusive of overhead and profit. Allowing eight to ten per cent for overhead and profit, 40 per cent of the total cost may be taken as an approximate estimate of rentals.

This estimate of rentals excludes labour employed on the site in equipment operation. The items of fixed cost (the basic rental) covered in the conventional engineering formula, are depreciation, interest on capital invested in equipment, maintenance and repairs, insurance, and license and tax payments. The sum of these is called the basic rental charge. The operating costs, which are added to the basic charge, cover fuel, oil and grease, transportation costs, and supervision. In addition, on any one job there is a profit allowance commensurate with the risk involved to the owner of the machine. All of these items of cost are implicitly included in the price tenders of the contracting firms. When the firm receives a contract, it must already own or be in a position to assemble the equipment for the job.

For the present purpose the interest is in the demand for new machinery and equipment that would accompany the initiation of the S.S.R.P. On the basis of an examination of the breakdown of the basic rentals of heavy construction equipment and assuming that a full line of equipment was assembled

in the first year of the project, written off, and wholly replaced at the end of the fourth year, the total value of the machinery and equipment required would be about \$12 million. Depreciation may be charged at 25 per cent on a straight line basis as this estimate assumes, but the equipment would hardly be scrapped and completely replaced at the end of four years of service.⁵ Therefore, \$12 million is an outside figure. Probably \$9 to \$10 millions of equipment at current prices would be sufficient.

The heaviest demand for machinery and equipment would occur at the beginning of the project. In view of the character of the project, a very large part of the equipment would have to be purchased in the United States. Initial expenditures would probably run from \$3.5 million to \$5 million and continue at a rate of about \$1 million a year until the closure year. This full line of equipment, assembled by the 4th or 5th year, would then serve with minor additions through the remaining years of the construction period.

Annual expenditures on new machinery and equipment by the Canadian construction industry have averaged more than \$50 million from 1947 to 1951. The expenditure was estimated at \$62 million in 1951. The prospect for 1952 is an expenditure somewhat higher than in 1951. About 50 per cent of this type of machinery and equipment has been imported from the United States.⁶ Since a specific description of the machinery and equipment required is not available, it is not

possible to determine whether or not difficulties might be encountered in securing particular units from the manufacturers in the United States. It should be noted that if Canadian subsidiaries of large concerns in the United States received contracts on the project, the machinery and equipment would possibly be supplied by the parent firm or firms.

In conclusion, barring specific bottlenecks, the demand for machinery and equipment that would accompany the initiation of the S.S.R.P. does not appear to be large enough to have a significant effect upon the economy. It is of interest, from the point of view of the impact of the project, that the only direct leakage to imports of any size from the initial outlays on construction is the expenditure on machinery and equipment. The concomitant demand for foreign exchange is a relatively slight one.

Conclusion.—The present chapter has examined the S.S.R.P. to obtain perspective with respect to its size as a construction project, and to indicate the variable nature of its real cost. Assuming an eight-year construction period for the main dam and reservoir, and measuring its cost in current prices, the annual expenditures accompanying the construction of the project would run at about \$17.5 million a year. The annual expenditures would rise to \$20 million in Year 6, and to \$32 million in Years 7 and 8, when construction began on the irrigation structures and the power plant. The relative

⁵ The basic hourly rental, excluding operating rental of a Motorized Tournapull, list price about \$40,000, is \$12.00. The annual (basic) rental for a construction season of 150 days would be \$18,000. The depreciation, plus five per cent interest, would be \$12,000. The

remaining \$6,000 would cover maintenance and repair, insurance, licence and taxes.

⁶ Data on investment by the construction industry were obtained from Economics Division, Department of Trade and Commerce, Ottawa.

size of the project as an engineering construction project is evident when these values are compared with the current levels of engineering construction in the prairie region and the country as a whole. Engineering construction was estimated in 1951 at \$196 million in the Prairie Provinces, and at \$860 million in Canada as a whole. It was forecast that, for the country as a whole, the value of engineering construction in 1952 would be \$1071 billion. Some of the increase in 1952 was an increase in real construction, but much of it was the result of the rise in the level of construction costs.

A more fundamental view of, and a better perspective on, the relative impact upon the economy of the construction of the S.S.R.P. was obtained through a consideration of the types and quantities of on-site labour, materials, and machinery and equipment required by the project. On this view, the labour demand emerged as the strategic factor. The initiation of the project would create a demand for an annual average labour force of about 1800 construction workers. Some of these might come from other regions in the country, but most of the workers would be drawn from the regional markets. The construction labour force in 1951 in the prairie region was approximately 36,000. The demand for labour accompanying the initiation of the S.S.R.P., with a liberal allowance for unskilled workers, would constitute a significant proportion of this total. Other projects would be restricted to some extent if the present condition of construction labour shortage prevailed.

The demands for materials and machinery and equipment associated with the S.S.R.P. could be absorbed with greater ease. The

bulk of the materials used have no apparent alternative use. The demands for other materials, with the possible exception of cement and steel plate, could be appropriately timed to impinge upon unused capacity in the plants involved.

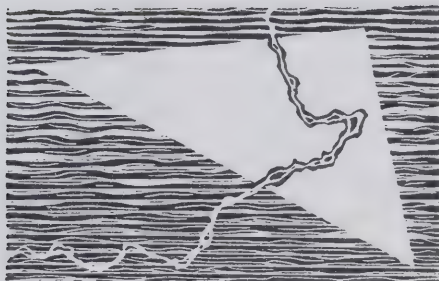
Construction costs are highly inflated at the present time relative to any comparison base in the past thirty years. How they stand relative to future price levels is an open question. If the "creeping inflation" of recent years continues, it is possible that the present level of construction costs may compare favourably with construction costs that will prevail after the next recession in construction activity. This point is relevant to the financial aspects of the S.S.R.P. For example, the direction and the degree of future changes in the value of money will be of utmost concern to the individuals who farm the irrigation project, if they are required to liquidate a significant portion of the debt that will accompany the construction of the project. However, this and similar financial considerations are independent of the thesis of this chapter. The essential point developed above is that the real cost of the project depends, to a considerable extent, upon the economic conditions that prevail during its construction; and, subject to the minor qualifications cited in the text, the real cost varies in a roughly inverse fashion with the prevailing level of construction activity. For this reason, if a maximum return from the South Saskatchewan Project is to be obtained, the question of the timing of its construction is important.

The S.S.R.P. is a public project of very slow fruition and one which will have an

indefinitely long life following its development. Variation within a period of a few years in the date of its completion will not greatly affect the value of its yield. Consequently, timing its construction to minimize its real cost would maximize the net benefit or return to the Canadian people.

Assuming that the S.S.R.P. is an optimum project in all other respects, it should be initiated as soon as there is sufficient slack

in engineering construction in the western provinces. The strategic resource involved in its construction is labour. The season of initiation and the scale of operation could be determined within the statistical framework which has been designed by the Federal Government to measure current and prospective conditions in the relevant labour markets. Supplementary data are available in the regional surveys and forecasts of investment activity.



PART III

Appendix

Submissions and statements filed with the Commission

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A Brief Presented to the Royal Commission on the South Saskatchewan River Development.

Lethbridge, Alberta,
May 2, 1952.

Mr. Chairman:

I appreciate the invitation to appear before this commission in a capacity of a practical irrigationist. I am somewhat at a loss as to the nature of the report that is expected from me. Most of my life has been devoted to the study and benefits derived from irrigation and it is my desire to bring to your attention my opinions on irrigation development.

In the first place, I believe that irrigation schemes are the responsibility of the Federal and Provincial Governments and that they should shoulder the major costs of construction and administration.

As a point for discussion, I believe that it could easily be proven that irrigation has been of inestimable value to all the people who reside within the boundaries of an irrigation district.

The proof of this assertion is for you to drive from Medicine Hat to Taber and to note what takes place as you approach the section of the country that has been developed by irrigation.

I once had the pleasure of flying over the St. Mary's Irrigation project covering the developed and the undeveloped sections. What a contrast was evident. The abundant crops that were being produced on the irrigated sections compared with the undeveloped sections was so striking one would actually have to see to believe.

As further proof I would like to compare the area from Magrath to Taber with any other section in Western Canada for the natural wealth produced under irrigation. Here are just a few of the agricultural benefits derived: canning crops, livestock feeding, sugar beets, irrigated pastures for grazing livestock, and increased production of grain crops.

Another important point I would like to make—that by the storing of our waters it gives us flood control in addition to irrigation benefits. Water controlled in storage and applied to the land during the critical growing months of July and August has a tendency to seep back into the rivers.

The water stored and applied to the land of the St. Mary's project fortunately parallels the South Saskatchewan River project. This in itself is ample proof that instead of lowering the supply of water in the South Saskatchewan, it will at the time needed have a tendency to increase the normal flow.

The question now is whether the costs will be justified when compared with the benefits received from the irrigation and power that will be developed on the South Saskatchewan. This could be worked out by the engineers.

In my humble opinion, no matter what the cost it will eventually pay off.

Respectfully submitted,
PHIL BAKER, Chairman,
South Alberta Water Conservation Council.

Irrigation on the Canadian Prairies

BY W. L. JACOBSON, M.A.I.C.

(Reprinted from *Canadian Institute of Surveying*)

Irrigation on the Canadian prairies dates back to the early ranching days when water was diverted from the smaller streams, by the more provident stockmen, to flood native hay meadows for winter feed. According to official record there were at the close of the year 1894 some seventy ditches constructed and in operation in Southern Alberta and Western Assiniboia. By the end of 1895 this number had increased to one hundred and twelve and the acreage under constructed ditches susceptible of irrigation from these works amounted to the surprising figure of 79,271 acres, according to the report on irrigation and Canadian irrigation surveys issued in 1896.

The prolonged drought of the "Nineties" served, apparently, to greatly intensify the demand for irrigation. The North West Irrigation Act, which was passed by the Parliament of Canada in 1894, provided for the survey of irrigation projects and administration of water rights. Construction was pushed forward and many millions of private capital were expended on irrigation works during the two decades preceding World War I. The first large-scale irrigation project was completed and put into operation at Lethbridge in 1901 and other large projects were constructed early in the century at Strathmore, Brooks and Vauxhall.

The Lethbridge Northern irrigation project, the United Glenwoodville and the Mountain View projects were all constructed after World War I and a number of community projects have been completed since 1935 under the P.F.R.A. The principal projects in this group are located at Val Marie, Eastend, Maple Creek and Swift Current in Saskatchewan, and at Leavitt and Cessford in Alberta, while a number of existing projects have been extended. In addition, more than one thousand individual irrigation projects have been constructed under P.F.R.A. during the past decade.

Today there are more than 1,568 individual irrigation projects authorized under provincial statute in Alberta and Saskatchewan with a total irrigable area of 129,500 acres, while large scale irrigation works serve 574,200 acres, making an over-all total of some 703,700 acres served by irrigation in Alberta and Saskatchewan.

The situation now, in the main, is similar to conditions that prevailed after the war of 1914-18. The basic need or demand for irrigation has been intensified by the prolonged drought of the "Thirties" as irrigation development in the early days had been by the drought of the "Nineties." Agricultural prices are moving upward, while the demand for good farm land has increased steadily with the growing demand for living space and food. As a result the further expansion of irrigation is a live question in post war prairie agriculture and the purpose in preparing this paper is to discuss the main factors which determine the need and benefit of irrigation and to indicate the extent to which this type of agriculture may be successfully extended under Canadian prairie conditions.

More than half a century of experience on the Canadian prairies shows that the need and benefits of irrigation are determined largely by climate, topography, soil, cultural practice and the market value of the crops produced.

The need for irrigation is determined almost entirely by climatic factors, including low precipitation, unfavourable distribution and high evaporation losses.

The need for irrigation may be affected to some extent by soil type, particularly in areas of marginal rainfall where soils of high moisture retentive capacity may be dry farmed quite successfully while very light soils, under the same climatic conditions, would be subject to frequent crop failure. However, soil is secondary since climate is the primary factor in determining the need of irrigation.

Climate also plays a major role in determining the benefits that may be obtained from irrigation. High growing temperatures, long days of sunshine and long growing seasons free from killing frosts are main factors in creating environmental conditions favourable for growing a wide assortment of specialized crops, where irrigation is available to supply any moisture deficiency.

Favourable topography is important because rough land cannot be satisfactorily irrigated. Rough land has been the cause of many irrigation failures in the past and while modern earth moving equipment has greatly extended the areas of land that may be successfully developed for irrigation, it is a fact nevertheless

that favourable topography, with uniform slopes between ditches, must still be considered a major factor in classifying any land for irrigation.

A wide range of soil types may be successfully irrigated, provided drainage is adequate and the root zone is free from excess salts. The medium to lighter textured soils are generally best suited for irrigation.

Soil type needs to be considered in relation to topography, particularly in respect to excess salts. For example, alkali is less likely to become a problem where topography is uniform, whereas any attempt to irrigate rough land, especially where the soil is light texture, is almost certain to develop alkali spots where seepage comes to the soil surface.

Intensive cultural methods and the proper use of soil improvement crops, green manures and fertilizers are essential in irrigation farming to ensure the highest possible level of production consistent with costs. Low yields result in increased cost of production and lead to failure, whereas high yields per acre afford a most effective means of reducing unit cost of production and increasing net returns from irrigation. The maintenance of an adequate supply of active organic matter in the soil and the use of fertilizers require special attention where water is applied to the land artificially and the natural balance between precipitation and plant growth is altered.

Finally, the crops produced must be marketable, either direct or through livestock, at prices high enough to pay the extra cost of irrigation. A large number of irrigation farms are operating quite successfully on a mixed farming basis. However, specialized cash crops are needed for maximum returns and especially to meet the competition of the dry land farmer.

The factors of climate, topography, soil, cultural methods and markets determine very largely the extent to which irrigation may be intensified and is a main consideration in the case of irrigation farming. Where irrigation is sufficiently intensified and the returns per acre are sufficiently high, the annual cost of maintenance and operation is not likely to be a problem. However, where yields are low or where the crops produced have a low market value, the annual water charges can very quickly become a burden to the water user.

In the case of most of the irrigation development on the prairies, the financing of irrigation works was based on the idea that the water users or owners of the lands directly served should and could pay the total cost of construction, including interest on all unpaid principal, in addition to maintenance and operation costs.

These projects, it should be pointed out, were constructed during a period of great industrial develop-

ment, agricultural expansion and increasing prices. However, the financial structures of these projects failed to withstand for the most part the economic stresses that developed following the first world war, and much assistance was needed to keep all of these projects operating. According to reliable estimate more than \$50,000,000 had been spent by 1930 by various agencies in developing large irrigation projects on the Canadian prairies, including cost of construction, maintenance, replacements and betterments of works.

Over development accounted for a large portion of this huge expenditure as indicated by the fact that works had been designed and built to serve over one million acres of land whereas little more than half of this area is now irrigable from these works.

Nevertheless the benefits of irrigation under the right conditions have been fully demonstrated, and a number of these projects comprise some of the richest agricultural areas of the west. A study made by the Economics Division of the Dominion Department of Agriculture showed that while irrigation was practised on less than three per cent of the improved acreage of the province of Alberta and was of major importance on not more than five per cent of the farms, yet the annual production on these irrigated farms accounted for almost ten per cent of the total production for the province during a number of dry years in the "Thirties." During recent years, when rainfall has been more plentiful, the ratio in favour of irrigation farming has no doubt been reduced, but the value of irrigation in the low rainfall area of the prairies has been fully established.

While the total benefits of irrigation were early recognized, the net returns accruing to the individual water users, particularly during the early years of development, proved inadequate in most cases to meet total construction costs in addition to maintenance and operation.

The principle now generally recognized is that since the benefits of irrigation extend to the community and to the nation, so the cost of establishing irrigation should be distributed and not be carried entirely by the water users.

A definite basis has not yet been worked out for the division of capital cost. However, it is generally agreed that the land served with irrigation should carry the total maintenance and operation costs. Moreover the strict adherence to this principle would seem imperative in order to establish any future irrigation projects on a sound economic basis.

The foregoing is a brief outline of the main factors that need to be considered in determining the agricultural feasibility and value of any proposed new irriga-

tion development on the prairies. The points presented can be most easily tested perhaps by examining existing irrigation projects since the results obtained from these projects, which date back in some cases to the beginning of the century, should provide the best measure by which the probable benefits of any new proposal may be appraised.

In considering the need and value of irrigation it is necessary to distinguish between irrigation farming as practised on the larger irrigation projects and small irrigation projects usually operated in conjunction with dry land farming or ranching. On the one hand, farming is wholly dependent on irrigation and on the other, irrigation is supplementary to dry land farming or ranching.

Irrigation farming is necessarily limited to large projects, while supplementary irrigation or the individual irrigation project has a much wider application. These two types of irrigation apply to different conditions and must be appraised differently.

In view of the importance of climate in determining the need and value of irrigation and the fact that climate varies so widely over the prairies, the location of a project becomes a major factor in determining its chances of success insofar as large projects are concerned. This is indicated on the accompanying map which shows the following information relating to irrigation:

- (a) Existing large irrigation projects.
- (b) Proposed large irrigation projects.
- (c) Boundary between the aspen grove belt and the grass land formation.
- (d) Average maximum daily temperature lines for the month of July.
- (e) Precipitation lines for yearly averages of 11, 13, 15 and 21 inches.
- (f) Main rivers, streams and lakes.
- (g) The "Dry Bowl" or chronic crop failure area of the prairies.

The most significant fact revealed by this map is that all large projects where irrigation farming has been established with any degree of success are located within the "dry bowl" area. This includes the various projects in the Lethbridge area served by the works of the Alberta Railway and Irrigation Company, the main portion of the Lethbridge Northern Irrigation District, the Canada Land and Irrigation Company project at Vauxhall and the Eastern Irrigation District at Brooks.

Irrigation provided by the larger projects outside of the "dry bowl" area, has been with few exceptions, only supplementary to dry land farming and for the most part the returns have not been enough to pay maintenance and operation costs.

The results obtained on the Western Irrigation District are of particular interest in this connection since the project is a large one and has been in operation since 1911. The climate here is affected by the Chinook winds, although the effects of higher altitude are reflected in lower summer temperatures than prevail in the "dry bowl" area of the East. The total annual precipitation, for the crop district in which the project is located, averages about 16 inches and wheat yields average 18 bushels an acre. As a result irrigation has been used to only a limited extent and mainly in the eastern portion where the project borders on or extends into the "dry bowl" area. Land owners asked to have their water contracts waived and the Company finally yielded where there was a one hundred per cent sign off in an area and the water could be completely shut off. As a result, much of the western part of the project has been abandoned.

A few years ago the Company turned the entire project over to the contract holders who had organized under the provincial Irrigation Districts Act. The annual water rental was increased from 50 cents to \$1.00 an acre but the users were allowed to reduce the acreage covered by water contracts to as low as 25 or 30 acres so that, in most cases, the annual water assessments per farm are lower. The water is being used mainly for domestic purposes, stock watering, garden irrigation and, to a lesser extent, for feed production. The project, therefore, is serving largely the same function as individual water developments are in other parts. The project has a good chance of succeeding under the present set-up since the cost of operation is relatively low and the capital cost of the works was completely absorbed by the company. Moreover a portion of the project at least extends into the drier area where it is possible, with proper cultural methods, to establish irrigation farming. It is a fact nevertheless that even after thirty-five years the use of water on this project, originally designed and constructed to irrigate 217,000 acres of land, is still largely supplementary to dry land farming or ranching.

The Mountain View Irrigation district in the foothill country of southwestern Alberta may be cited as a successful small community project where irrigation is supplementary to dry land farming. A feature of this project is the low cost of operation and maintenance which amounts to 20 to 30 cents an acre annually.

The fifteen hundred or more individual irrigation projects scattered over the prairies, and a number of small community projects constructed under P.F.R.A., provide irrigation that is supplementary to dry land farming or ranching. These projects, along with some 26,000 dugouts and small stockwatering dams con-

structed during the past decade under P.F.R.A., constitute a factor of the utmost importance in the agricultural life of the Canadian prairies. Shortage of water is generally a limiting factor in the case of individual irrigation projects where the supply must come from local runoff, but nevertheless these small projects possess some very important advantages. Where needed, small water projects may be developed on most farms across the prairies, while the costs of construction and upkeep are generally low. Wide distribution and low cost are two important advantages. As a result these small projects possess a high rehabilitation value and provide one means of fortifying prairie agriculture against drought.

The results, therefore, do not show that there should be no irrigation outside of the "dry bowl" area. However, the results indicate that irrigation outside of this climatic zone has a lower agricultural value and, therefore, to be established on a sound economic basis, the cost must be low, keeping in mind the fundamental principle that irrigation should pay operating and maintenance charges in addition to a fair share of capital costs.

With regard to new developments it may be pointed out that three of the larger proposed projects are located within the "dry bowl" area. These include the St. Mary and Milk Rivers extension, providing for 345,000 acres of new irrigable land, the extension of the Canada Land and Irrigation Company project at Vauxhall, estimated at 100,000 acres, and the Red Deer river diversion project, where some 270,000 acres may be irrigated.

More studies and investigations are required, particularly in the case of the Vauxhall and Red Deer River projects. However, the St. Mary-Milk River project, the Vauxhall and Red Deer projects, involving more than 715,000 acres of potentially irrigable land, afford the maximum opportunity for irrigation farming and the successful operation of large scale irrigation on the Canadian prairies.

It should be pointed out that climatic conditions are not uniform throughout the "dry bowl" area. There are, in fact, some marked differences between the southern and northern portions. In the area lying generally between Taber, Medicine Hat and Vauxhall, precipitation is lower and temperatures are higher than in other regions of the prairie provinces. The growing season varies from 120 to 140 days in the southern area, as compared to 120 to 130 days at Brooks and about 110 to 120 days at Hanna.

Another interesting comparison is that ranchers in the northern portion of the "dry bowl" area usually have to feed their cattle three months or more during

the winter while ranchers in the south usually do not have to feed more than three weeks due mainly to the influence of the Chinook winds. The region is of course subject to wide variations in climate and some extremely severe winters have been experienced when large amounts of feed were needed to prevent heavy and often disastrous losses. Irrigation therefore is very important to the ranching industry in this region.

With the higher temperatures and longer growing season that prevail throughout the southern portion of the "dry bowl" area a wider assortment of specialized crops are grown where irrigation is available. As a result, a highly intensive agriculture has been developed along with a number of secondary industries, including beet sugar refineries and vegetable canneries.

At Brooks, located near the center of the dry area, irrigation is based mainly on mixed farming with grain, alfalfa and livestock as main products. High quality seeds of various kinds are grown in considerable quantities, including peas, beans, alfalfa, clovers and a number of vegetable garden seeds. Potatoes of the very highest quality are grown and are gaining in importance as a commercial crop. Sugar beet growing has not yet been established here, although in tests conducted a number of years ago high yields were obtained with high average sugar content.

The proposed development in the northern portion of the "dry bowl" area north of the Red Deer river, where growing temperatures are somewhat lower, would likely depend mainly on mixed farming, with alfalfa and possibly coarse grains as main crops. These would work in well with the livestock industry of the region and the utilization of adjacent grazing lands.

The extension of large irrigation projects beyond the "dry bowl" area is limited by the four basic factors of climate, topography, soil and economics. Moisture is the major limiting factor in crop production throughout the prairies and heavy losses have been suffered through low yields and crop failures. However, there are no indications that any further attempt to establish irrigation farming outside of the "dry bowl" area would be any more successful, for example, than in the case of the Western Irrigation District where attempts to establish irrigation farming failed even though the annual cost of water was only 50 cents an acre.

There are in fact no extensive areas of land, outside of the "dry bowl" area, that are topographically suited for irrigation farming. The areas of land that might be benefited by irrigation are generally too rough, whereas the areas of land with suitable topography usually consist of the clay soil types with high enough moisture holding capacity to be dry land farmed quite successfully.

As a result, any possible irrigable areas, outside of the drier region of the prairies, are limited in size and widely scattered. This, combined with the fact that the rivers east of the third prairie steppe run in very deep valleys, would make any such large irrigation development very costly to construct and also to operate and maintain.

With regard to extending irrigation on the Canadian prairies, it would seem insofar as larger projects, involving irrigation farming, are concerned, that such expansion should be made within the "dry bowl" area where the need is greatest and where, because of climate, topography and soil, the water available can be used to best advantage. The success achieved with irrigation by existing projects in this area provides the strongest possible argument for further development within this climatic zone.

There is need for irrigation outside of the "dry bowl" area but its use, because of climate, topography, soil and cost, must be largely supplementary to dry land farming or ranching. Such developments, having a low cost of construction and maintenance, offer unlimited possibilities for improving living conditions throughout the low rainfall area and provide a principal means of stabilizing agriculture in this area, particularly during periods of drought.

Supplementary irrigation is supplied mainly by small individually owned and operated projects. The works of these developments vary widely depending mainly on available water supply and topography. Individual irrigation projects could be increased in number to five or six thousand and, on the basis of the present average of 30 acres or more per scheme, this would add very substantially to the irrigable area of land over the prairies.

Supplementary irrigation may also be provided through small community projects under favourable conditions. One main essential of such projects being low cost, keeping in mind that such works should carry maintenance and operation charges. A number of projects of this nature have been constructed under P.F.R.A. and others have been studied and recommended for construction.

This programme includes plans for developments on the Souris river, in the Qu'Appelle Valley, small pumping projects in the valleys of the South Saskatchewan and Red Deer rivers and several projects in the Cypress Hills and foothill areas. These projects, if developed, might ultimately serve 100,000 or more acres of irrigable lands.

A number of other projects have been proposed. One proposal was to irrigate an area of some 800,000 acres of land between Elrose and Saskatoon by

diverting water from the South Saskatchewan river. An agricultural study showed, however, that this area is unsuited for large scale irrigation due to climatic, soil and economic factors.

A proposal now being investigated would involve the construction of a dam on the South Saskatchewan near Elbow. The purposes of this project would be to (1) develop electric power, (2) provide water for municipal purposes, (3) divert water into the Qu'Appelle river for the purpose of irrigation and restoring and maintaining lake levels in the valley. The feasibility of this project will depend on various engineering features, particularly foundation conditions and various economic factors, such as cost, the value of the power produced, the part of cost that may be charged to municipal water supply and the probable value of the project for various other purposes, including any irrigation that may be developed.

The expansion of irrigation on the Canadian prairies, on the basis of past performances of existing projects and present knowledge, should—

(1) provide for the fullest possible use of water within the climatic zone of the "dry bowl" area;

(2) include a greatly expanded programme of individual water developments; and

(3) provide for the construction of community projects in accordance with local needs and conditions.

Such a programme of water development, combined with sound farming practices to conserve moisture and control erosion, should help greatly to improve living conditions and make for a permanent agriculture throughout the low precipitation areas of the Canadian prairies.

A Brief presented to the Royal Commission at the hearing held in The Town of Outlook, Tuesday, September 9th, 1952 in connection with the South Saskatchewan River Dam near mouth of Coteau Creek.

MR. J. DAVIDSON

Gentlemen of the Royal Commission:

GREETINGS

It is with pleasure that we welcome you on behalf of the Citizens of the Town of Outlook and wish that your stay with us will be a pleasure to you and also profitable to us.

We are more especially pleased with your visit with us as we are about to present information and discuss with you the possibilities that irrigation could have for the town and district by providing a constant supply

of moisture to the growing crops when it is most urgently required, and in order to produce a crop sufficient to support the district.

Outlook is considered the trading centre for a considerable portion of the contemplated area which the dam at the proposed Coteau site would service yet, in this town, we have not a facility to handle the agricultural produce of the district. Grain handling organizations and the concerns who usually handle agricultural products are, apparently, unwilling to risk their capital to provide these facilities owing to the uncertainty of the amount of rainfall during the growing season being received to produce crops in this area. It is one of the very few towns in our province that has not a grain elevator.

This season the Outlook district has a fair average crop of grain, which, to the seeded acre, could average possibly 20 bushels. On the P.F.R.A. pre-development farm which is supplied with irrigation, the wheat averaged 48 bushels per seeded acre, the barley 47 and oats 45. We believe that with irrigation, the district could average these figures each and every year.

The district at one time supported a creamery which was located at Outlook. With the scarcity of feed and water following the extreme drought farmers were forced to dispose of their cattle herds and the creamery was compelled to cease operations.

The town's supply of milk is now shipped daily from Moose Jaw, a distance by rail of 121 miles. As can be seen, these conditions have created a difficult situation insofar as supply sufficient quantity of milk to properly sustain our children. These conditions were created by our dairymen being forced out of business as they could not secure feed for their cows, yet on the predevelopment farm at the south edge of this town, 35 tons of alfalfa hay was produced from 12 acres of land, a good part of which, prior to 1950 was used by the town as a nuisance ground. Better land on this same farm has produced over four tons of alfalfa hay per acre.

As a further indication of the effects of drought conditions on this community, prior to 1930 the assessment value of this town was over \$1,000,000. Today it is near \$436,000. During the dry 30's the population of Outlook shrunk to 500. Over one third of these citizens were on direct relief for all the requisites essential to a bare subsistence.

Past history has taught us that we will again have droughts, however, with irrigation we are confident that this community and its people will not again be subjected to such desolation and heartbreak as experienced during the 30's.

Gentlemen of the Royal Commission, we sincerely trust and pray that your decision will be favourable and that the Federal Government of this fair Dominion of ours immediately will take the action necessary to the implementing of the South Saskatchewan River development project.

A Brief Presented to the Royal Commission Regarding Farming Experience in the Outlook Area

By J. C. CARTER

Gentlemen of the Commission and fellow members of the S.R.D.A., I have been requested by the Outlook Chamber of Commerce to present a brief to the honourable members of the Commission now sitting. I am not familiar with the form of brief that is usually presented on such occasions, and I have no figures or statistics, so that recollections of personal experience and observation during nearly fifty years of residence in this district will be perhaps acceptable. First recollections go back to the fall of 1903, when homestead-seeking with the Dominion Government Land Guide, Marcotte, from Saskatoon. A fact that did not seem significant then, but has been recalled a number of times since, was that the prairie was burnt and parched and that the sloughs were all dry. Scrub vegetation was poor and the grass was thin, with little growth. I understand that frequent prairie fires due to dry weather were partly responsible for this. In the next few years we gained considerable experience in fighting prairie fires, which nevertheless did considerable damage. During the winter of 1903 and 1904 snowfall was quite heavy, and also during the early spring there were some heavy rains and this combination filled some sloughs and partly filled others. The promise of the rains in spring did not continue, and the summer of 1904 was hot and dry, with burning winds from the south. We had put in a little barley on spring breaking, but it burnt out, from the heat. From observation since I have concluded that the summer of 1904 marked the end of a dry period, for the next five or six years were first very good, then good to fairly good. Indeed on ten acres of breaking and back-setting in 1905, the yield was 52 bushels an acre of wheat. Oats on breaking yielded as high as 100 bushels per acre. I believe, personally, that perhaps the strength of the new soil played a good part in the heavy production. In 1913 conditions began to change and dryer weather set in. It began to become more difficult to bring crops to maturity in the proper season. I had no personal experience with the years between the latter part of 1915 to the middle of July 1919, as I was overseas with the Canadian

Expeditionary Force, but I have been informed that 1917 was one of the most disastrous seasons experienced on the prairies. On my return to Canada and this district it became evident that unfavourable weather was again setting in and, in fact, had already begun. We entered into the 1920 period during which the years were very uneven. Some years were fair as to production. There was perhaps one crop which could be called good and hail did a great deal of damage that year. I mean that the crop was good for this district, but unfavourable conditions were more of a feature than favourable ones. It was in the early nineteen twenties that a new peril appeared. I refer to the plagues of grasshoppers which clouded the sky and covered the land, devouring all crop, and in several years being so extensive that after finishing the crop they devoured clothes on the line and elsewhere. It was quite evident that these were dry weather plagues, because in years with heavier rainfall they were not so much in evidence, and the damage was quite negligible—newer methods of fighting also helped. In my opinion what is now vulgarly referred to as the "dirty thirties" was really born in the 1920's. With lack of moisture, winds seemed to grow stronger and soil drifting to an alarming extent, began. I could take you to areas in this district in which there are rural roads, previously lined with fences and scrub growth, which have been built up as high as five feet above the surrounding fields from which the top soil had been blown. Heavy land will blow as badly as light land when dry. You know, gophers do not dig in sandy or other loose soil but require a clay substance to hold their burrows together. I have seen in this district soil erosion to such an extent that the gopher burrows stood up like pillars above the surrounding level. We have a snapshot of our old dog, a big black part-Newfoundland, actually reaching up to sniff at a gopher hole. The "dirty thirties" are still too recent to require much recall. The droughts with total failures, near failures and partial failures, grasshopper plagues and other insects, hot burning winds and drifting soil all conspired to cause a great deal of distress and to make life miserable.

I have read that a considerable portion of the Sahara Desert was once a fertile and pleasant land with crops, vegetation and trees growing freely, with apparently plenty of water to nourish them and with large, well-built cities and rural areas. Drifting winds occasionally uncover from the sand evidence of this, only to cover it again. What caused the change we do not know, but it can only have been failure of the water supply. It does not require a great stretch of imagination to those here in the thirties to induce the

thought that under the conditions then existing, which may return, this area and a large part of Saskatchewan could easily become desert land. There is a part of this district where the sand is moving all the time, extending and covering all in its path. In dry years the movement is more rapid and extensive.

There were years, however, in which a reasonably good crop was produced. It is a fact that wheat will mature with less moisture than many other crops (except the Russian thistle). The year of 1932 will no doubt be remembered by many. Quite a good crop, and yet it occasioned as much distress as the years of crop failure. Some of you will remember that in the fall of 1932 and part of 1933 wheat sold as low as 20 cents per bushel. You do not need to be told that no farmer can raise 20-cent wheat and begin to pay his way. It were better to have no crop at all than the load of debt which the expenses of a crop at such a price will bring. The ability to diversify and to raise other crops with a market value, with the aid of water, would have eased this distress considerably.

I had the pleasure of speaking in an impromptu address before a meeting of the members of the S.R.D.A. in the Outlook Park last June. I referred then to the surroundings in which the meeting was being held and mentioned the fact that in Outlook Park was the only grove of natural elm trees in this province, or at least the only one with trees of their age. I mentioned that from the rings shown in the stumps of several that had been felled years ago their age had been estimated at over 800 years. Incidentally, through the Star-Phoenix, I have heard one or two doubts expressed as to the age quoted, and to those who doubt I would like them to examine a number of elm saplings which were planted by the Council for replacement purposes during the years I was Mayor, over a decade ago. Then compare the growth with the old trees still standing. However, that is by the way.

What I did not say then was that, besides determining the growth and years of life of these old monarchs, the rings of growth also show the kind of seasons that have passed during the centuries of growth. The narrow rings show the dry seasons. The wider rings show the years of more adequate moisture—I almost said showed the wet years—but, during my residence here, I have never known a really wet year as compared to other parts.

It is interesting to note that the rings showing the dry years very considerably outnumber those showing the moister periods. This recalls to my mind another circumstance. Some years after I came to this district I saw an old soil survey map. Had I seen it before

coming here it is doubtful whether I would be here today. My recollection of the map is that it was made by Government surveyors before much of the western prairies were settled, or indeed laid out in township and section. The map showed the nature of the soil from the heavy black land of the Red River Valley, the lighter black loam further west, the sandy land, what is known as the Weyburn clay, to this soil we know so well and which extends on both sides of the South Saskatchewan River, "the chocolate loam". And this chocolate loam was referred to on the map as a "semi-arid soil" and indicated that it occurred in a "semi-arid region". Some of us who have lived here for years can well understand this classification. However, semi-arid or not, this soil will produce crops with a minimum of moisture, but, for a well-balanced economy and the ability to grow other money crops besides wheat, water is needed in the proper quantity at the right time.

In my judgment there are signs that the fairly favourable crop conditions of the past few years are due for a change. We have had no considerable rains for the past two months and we are now at the season when fall rains can be expected, with as yet no sign of them. Those fall rains are necessary for spring moisture; snow runs off too quickly. Without the rain the spring seed-bed is a dry one and a sure indication of a dry season. I have noticed in digging in garden that the top soil is dry for a considerable depth.

Without water we must be content with a spasmodic and unstable wheat economy. With it this soil will grow anything that a temperate climate such as this can grow. It is unnecessary to point out that the economic stability of a large part of Saskatchewan would be vastly improved, if such were the case, and that the benefits would be felt throughout the whole of Canada.

Give us the water, and we will feed not only Canada but the hungry and starving in other lands.

Brief of the Saskatchewan Rivers Development Association

DR. W. B. TUFTS

TO: The Royal Commission on the
South Saskatchewan River
Project.

Mr. Chairman and Gentlemen of the Commission:

First I wish to express to you the appreciation of the S.R.D.A. for the interest and energy you have shown in your investigation of the South Saskatchewan River development project. I do not need to tell you

how much the people of this province are awaiting your decision, which they trust will be favourable, as you consider this scheme which we deem so vital to the economic life of our province. To us it is no longer a question of dollar returns, but through the sad experiences of the past, born out of stretches of bad years, it has become a problem of maintenance of proper standards of health, of education, a wish for security, and freedom from want and fear. It has become a wish, not for wealth, but for economic welfare and a restoration of our proper place in the whole Canadian economy.

You might ask why this association—the Saskatchewan Rivers Development Association has assumed the right of appearing before you today on behalf, not only of the farmers and business men in the development area, but throughout the province.

Briefly: this association was formed some years ago on the insistence of those groups of people within our province who were interested in irrigation and believed that through irrigation could come that security to combat economic and social problems created by our years of drought.

Today, it not only speaks for such urban centres as Saskatoon, Moose Jaw and Regina, but also, through their municipal membership in the S.R.D.A., for many thousands of farmers within this province. Besides which, as you will learn during the course of your hearings, it receives the support and endorsement of such influential farm groups as the Saskatchewan Wheat Pool, the Saskatchewan Farmer's Union, and the Saskatchewan Association of Rural Municipalities. When then we are asked: "Do you think the farmers will use the water: are they in favour of irrigation?" . . . then we consider this support . . . we contemplate the farm rally one year ago when 1,000 farmers from 29 rural municipalities attended . . . we refer to the resolutions that the rural municipalities and Agricultural Councils of this area have forwarded to the government, and I have no hesitation in saying to the gentlemen of the Commission or to our government: *Do not fear—the water will be used.*

In the presentation of this brief, gentlemen, we do not intend to burden you with figures . . . figures you will be hearing over and over again . . . figures and statistics you will know better than we do . . . and they will be used only in a small way to illustrate the larger picture we wish to present.

Also I am not a farmer . . . you will hear from farmers qualified to speak of arid acres, but I am a physician and I do know people and their homes. And twenty years of work in this district has carried me into

many homes, scarred forever by the privations of lean years. Most marked, assuredly during the "black blizzards" of the thirties . . . years that will come again just as surely as we are sitting here today.

We wish in our brief to first outline to you certain broad concepts of irrigation upon which our thinking rests and their application to our problem in Saskatchewan:

The greatest asset Canada has is its people. Their security and welfare are Canada's greatest responsibilities.

We concur with the Hon. C. D. Howe when he says: "When we think of irrigation it is not so much a question of watered acres but rather the happiness, security and welfare for the people living on those acres".

And with our Prime Minister when he says "No government can tolerate a situation where Canadians have to move from place to place because they cannot make a living where they are".

We believe that in the future development of Canada the development of her water resources will be one of her important, perhaps most important features; so important indeed, that regardless of what we may do here today, Canada, one day, must see that all these Central Plains of Saskatchewan and Alberta lying within the South Saskatchewan River Basin are farmed under a system of controlled water.

We further believe that, as the history of "this valley" has shown, time well may be running out on us now and soon again there will be upon us those dry, lean years which have threatened so many times before and were so severe in the "thirties". The P.F.R.A. Act was passed in the hope that through it would come the anchors to hold us against such another era in the west.

In so thinking we conceive the South Saskatchewan River project as such a scheme. One which should be commenced as soon as possible *because* no similar project considered by anyone anywhere in the west can so quickly and thoroughly stabilize and secure the agricultural economy for Canada.

Inasmuch as:

1. It will stabilize the economy of an entire province rather than any one region.
2. It has been declared technically feasible and all plans are available . . . in other words it is ready to go . . . and speed may be most essential as in a world of international tensions we step out, as a world power, to compete in the foreign markets.

3. While only one unit in the ultimate South Saskatchewan River Basin Development, it is the largest: it is the most singly important: and its construction will assist the later developments above it.
4. Hesitation at this time for further investigations, further considerations, will consume so much more money and so much more time that any savings that might be suggested would be lost many times over in lost income and probable relief payments to this area while these investigations were being carried on.

You have driven through this area. We are glad you had this opportunity of seeing how fertile these valley acres are when given a little rain at the right time. We are also sure that you must have been impressed by the potential tragedy that stalks through these lands, even in "good years", where we are dependent on a one crop economy . . . Wheat. Wheat lying piled in the fields for lack of storage . . . wheat that in a time of curtailment of world markets could well become but mouldy bread in our pantry which no one would buy.

And we are reminded that, of all the 4 western provinces, we *alone* in Saskatchewan lack that diversity of economy which makes for stability.

We are the weak link of Confederation . . . here strengthening is needed most . . . here Canadian dollars could be best spent to yield the most in returns.

As you drive through the country this fall you see the end of another year of risk and struggle . . . this time successful. Another will soon begin and perhaps not be so successful because this is an arid country . . . a country of drought cycles . . . of blistering winds and searing heat. And these adverse factors are predominant, so that, on the average, the people living in this area live precariously.

For Example: The rural municipality of Rudy lying adjacent to this town of Outlook is typical of the whole southern half of the proposed area.

1931-1950—average wheat yield was 6.9 bu. per acre.

1931-1941—a 10 year period . . . less than 5 bu. per acre.

1941-1950—4 paying crops . . . 1939-42-43-44.

1931-1951—relief of "dried out bonus" . . . 17 yrs. out of 20.

The average net income has been \$600 per year or \$50 per month. A state of existence so insecure

that in 20 years \$57,000,000 ($\frac{1}{2}$ the total cost of the Dam) in direct relief has been paid by Canada into this area.

This is what the rest of Canada has paid in, but how do we estimate the effect on municipal finance . . . the small town merchants who "went to the wall", bankrupt . . . the numerous pages of ledger accounts finally destroyed.

What greater evidence do we need that this area has at times become, not an asset, but a drag on our Canadian economy.

Where else could Canadian dollars better go to restore an adverse economic balance.

But even a greater disaster than drought's effect on the dollar economy has been its effect on the people and on the social structure. Losses that can never be measured in terms of dollars and cents.

How do you estimate the personal tragedies of these plains? . . . how do you gauge the effect of dozens of closed schools? . . . closed churches? . . . abandoned homes? What is the effect on the minds of these people who have had to live a nomadic existence moving from place to place hoping somewhere to find a living?

Population: One of the worst results has been the general depopulation of the province at large and this area in particular.

in 1925: farm pop. in area 31,000, in 1951, 16,300

In the province this loss in 10 years, 1941-1951, has been 66,817 but if you add the number of births (137,308) it becomes a loss of 204,125. Enough to wipe out every city in the province.

and $\frac{1}{3}$ of this has been in the project area.

and this at a time when Manitoba has shown an increase of 5.8 per cent and Alberta 17.6 per cent.

If people are a country's greatest asset then Saskatchewan is suffering the Prairie's greatest catastrophe.

Education: . . . because the exodus is one largely of youth, who go to seek opportunity when none exists here, the picture is well seen in our school situation.

In Outlook School Unit: 1931	4,114 students
1951	1,600 students
1931	110 schools
1951	67 schools

and I quote from the Department of Education:

"Unless school authorities can be assured of a more reliable and dependable income then an adequate program of education cannot be expected in that area"

Social Conditions

Here in this area where the population is so sparse that only three people per sq. mile live on its lands, those who remain are courageous souls living in a constant state of dread.

Fear of what? I mention only a few told to us every day:

1. Fear for the young children . . . school beginners . . . having to be sent miles to school in winter weather . . . travelling by truck or bombardier.
2. Fear of accidents: of childbirth: of illness miles from medical or hospital care on snow blocked roads.
3. Fear of being alone in a countryside where friends and neighbors no longer live.

This then, is the picture of the proposed development area over the past 20 years. If irrigation will promote a security of economic conditions which will correct these conditions then there is the need for irrigation.

AND WE BELIEVE THAT IRRIGATION IS THE ANSWER

Economic Considerations

However, I assure you, gentlemen, that if the S.R.D.A. did not consider that the effects of this improved economy would spread throughout the whole of Canada, and that the economic credits would far outweigh the debits to the whole Canadian people, then we would not be here today urging the expenditure of these public funds.

Economic Debit

We presume that the debit is the cost to Canada of the project less the provincial share of costs. We do not presume what this cost may be. We do know what the original estimate stated as costs but are quite prepared to accept that this figure may be raised due to increasing costs everywhere.

Nor do we consider this too important since:

1. We believe that irrigation projects should not be required to show financial feasibility i.e. self liquidation.
2. That financial feasibility is not an adequate consideration of the cost-benefit situation.
3. That economic feasibility is the important factor including the broader concept of the many benefits which result from its development. And these are so great that they will easily repay the dollar cost to Canada.

*Economic credits**A: to proposed area: regional benefits*

1. Stability of production of cereal grain crops . . . with an expected increase from a wheat average of 6 bu. acre to average of 40-60 bu. per acre.
2. Diversification of field or specialty crops.
3. Creation of a livestock industry . . . where none exists today.
4. Improvement in municipal finance . . .
 - (a) construction of all-weather roads.
 - (b) improvement of schools.
 - (c) increased social services.
5. Re-population of Area:

Through creation of some 1,500 new farm units.

Population increase from 3 people per sq. mile to 30 might be expected with retention of our own youth and influx of new settlers. The tendency would be to the more economic small farm unit instead of the uneconomic and unsocial tendency of today toward larger farms and fewer people.
6. A greatly increased home market for farm and manufactured goods.
7. Power development at damsite would form a basic power grid for a greatly increased power development, bringing:
 - (a) cheap domestic power.
 - (b) industrial power.
8. Power and varied crops might well see a creation of local industry within the area for processing and handling local products.

B. to the Provinces: sectional benefits

1. It should be borne in mind that while the project area involves a present 500,000 acres of irrigable land that stability will be carried to 20 times this number of acres or 10,000,000 which represents:

approx. $\frac{1}{2}$ the total sown acreage of the province. $\frac{1}{3}$ the total cultivated acreage.
2. It will bring about the diversification of field crops and make the province less dependent on its one crop . . . wheat.
3. It will create a livestock empire where none exists today.

Sad indeed is the history of attempts to create a cattle industry here. Trial after trial has ended in failure due to:

 - (a) Short fodder crops necessitating forced marketing.
 - (b) And in the worst years, cattle death and destruction due to crop failure, with the result today there is just no incentive to

building up herds. Compare this uncertainty of trying to feed 1 beast on 40 acres as to raising $1\frac{1}{2}$ beasts per acre on irrigated pastures. Not only would a cattle industry be possible within the area but with the creation of irrigated community pastures and feeding lots this area could well absorb stock from the whole province in times of temporary glut on the world market.

4. It will reverse the depopulation trend within our province and with more people we will find:
 - (a) a greater domestic market.
 - (b) our youth will stay here as an expanding diversified economy both farm and industry provides greater working opportunities.
 - (c) it will give us a greater voice in Canadian affairs . . . as each census sees us with fewer and fewer members in our Parliament.
3. A great provincial hydro-electric power potential for the development of industry where practically none exists today.

These benefits just outlined are not inconsiderable but if, gentlemen, we could advance to you nothing other than advantages and benefits of a regional or sectional interest we could not appear before you today without an apology.

If we did not feel that the South Saskatchewan project is of inestimable value to the whole Canadian economy and one in which Canadians might well place their public funds with full assurance of its overall benefits then the S.R.D.A. would hesitate to present this brief to a Royal Commission.

But we do feel that the gain will be to Canada and it is of this I would now speak.

Benefits to Canada

With the initial thought that these benefits to Saskatchewan concern a large group of Canadian citizens, I also feel sure that, quite apart from dollar returns, no Canadian government need feel reluctant to spend tax dollars to improve the lot or secure the welfare of Canadians anywhere.

However, in considering the more direct benefits to be obtained throughout the whole country from moneys expended we believe that certain factors should be borne in mind.

1. That a multi-purpose concept is the central theme of any plan for the best use of water resources:

To this the South Saskatchewan project fully subscribes in that it embodies the features of: Irrigation, Power, Flood Control, Municipal Water Supply, Recreation.

We feel that consideration of this multi-purpose plan assures a better overall support by a greater number of citizens.

2. That resource development must today embrace the broader concept of economics. It is not merely a question of bringing water to dry acres: it is not merely a question of more production and more dollars . . . it is a matter of the fulfilment of human needs.

Such is the South Saskatchewan project . . . Water to Saskatchewan means more than "Gold" . . . it means "Life".

3. In an estimation of a cost-benefit ratio, indirect, as well as direct benefits must be considered:

As to Direct Benefits

How are we going to measure these?
Over what period of time?

We are prone to base direct returns on probable production differences between dry and wet farming periods. But total production values are the important figures:

e.g. it has been estimated that production under irrigation in this area will be tripled.

On this basis of wheat production over a 20-year period of average crops and average prices, how would Canada's dollar cost be repayed.

If we subtract the \$57,000,000 direct relief paid out in this time, and the \$33,000,000 provincial share of costs, we then find that tripling production values would pay back the people of Canada \$340,000,000 in 20 years . . . for some \$70,000,000 expended.

But that is presuming the difference in wheat production is between the 6 bu. dry average and a tripled 18 bu. But it is known that on irrigated lands the production may be nearer 40 bu. per acre.

But then again we know that wheat will not be the whole economy . . . so how do we estimate total production of cattle or of specialty field crops where none exist today?

Indirect Benefits

These are many and varied and are just as important but even more difficult to assess.

When we consider the great increase in the domestic market for all Canadian goods produced by a greatly increased population within the area, and when we consider the purchasing power of the area tripled, or as I have tried to show, reaching levels of height that cannot even be estimated now and of every one of these dollars earned, 85 cents will go into the whole

The South Saskatchewan River Project

Canadian economy . . . then some idea may be obtained of the vast and incalculable benefits Canada will receive for its expenditure.

Does it not, gentlemen, become a question of only economic feasibility. It will always be financially feasible.

There remains but one big question to answer:

Where should development begin? . . . and this reverts in turn to your term of reference regarding the best uses of the waters of the South Saskatchewan.

This we believe to be the South Saskatchewan River project which you now have under consideration.

We do not wish to appear to support a plan just to make a "Desert Bloom". As Canadians we prefer to see the design for our development for the "long run". We also wish to avoid a narrow regional or sectional point of view.

But we do believe that the South Saskatchewan River project best fulfills those requisites of a sound national program for the conservation and development of our prairie waters . . . and at the same time best subscribes to those fundamental concepts of irrigation economics.

Because in this Project

1. It is not a question of bringing water to dry acres so much as bringing happiness and security to those people who now over a broad area, well-developed with highways, railroads, schools, and other services, exist on a low average standard of living due to drought.
2. It is a multi-purpose project affording greater public interest within and without the Province.
3. It will serve to stabilize the population in the only Western Province showing continuous population shrinkage.
4. It will diversify and put on a sounder basis the only Prairie Province which is essentially dependent on one economy—Wheat.
5. It will bring industry to a province with a low industrial output and create a sounder industrial-farm ratio.
6. It will create a livestock industry . . . where none exists . . . and which may well in the future, prove to be Western Canada's soundest farm economy.
7. No province in "lean years" is so dependent on public assistance which would thus be saved and counted as contributing to the capital cost of the dam.
8. Nowhere in all the prairies is there such a low rainfall area where so much dry land can be irrigated from a close available water supply.

In short, this project will secure for Canada its greatest single area of insecurity . . . *Saskatchewan.*

These, gentlemen, are the benefits . . . some of which can not be measured in dollars and cents . . . some that never appear in statistics . . . but taken together, as a result of this project, Canada can bring about the economic stability of a great province and put it into its rightful place in the Canadian economy.

. . . where it can be forever, not only independent, but pulling its fair share of the load as Canada moves into the greatness of the future.

. . . not a liability, needing relief 17 years out of 20, but a great province peopled by a great people . . . not only in numbers but great in social conditions where fear and want are forever gone, and we find instead, comfort and security.

Our forefathers, 100 years ago, envisioned on these plains, a great Empire of green acres with its millions of people. In our hearts and hands today lie the means to bring this to reality.

On this, gentlemen, we rest the brief of the S.R.D.A.

Respectfully submitted this 9th day of September, 1952.

SASKATCHEWAN RIVERS DEVELOPMENT
ASSOCIATION

WM. B. PUGH, M.D. *President*
G. O'SHAUGHNESSY, *Secretary.*

Submission by the Saskatchewan Farmers Union to the Royal Commissioner Investigating the Proposed South Saskatchewan River Project

MR. W. W. COATES

Introduction

It is not the intention of the Saskatchewan Farmers Union to examine in close detail, the various statistics concerning the development of the proposed South Saskatchewan River project. It is our understanding that previous examinations by qualified construction engineers and specialists in irrigation have covered the many problems that inevitably arise when consideration is being given to the outlay of capital expenditure necessary for such a project.

We would respectfully urge the Commission to consider the desirability of refraining from any judgment of the project on the basis of monetary value or cash expenditure alone. It is our considered opinion that the contribution of such a project will be, in the years to come, of such social and economic value to

the prairie region and Canada as a whole, that it would be irrelevant to attempt to assess this value solely in terms of an operating balance sheet.

Many great national projects, which might have been considered uneconomical in the first instance from a balance sheet standpoint, have made tremendous and lasting contributions to the national welfare. Thus we submit that the South Saskatchewan River project should be considered in the light of its long-term value to the nation. Nor should Canada be denied, we submit, the value of such a project due to what some may consider a relatively heavy expenditure at this time.

It has been inferred, in some quarters, that now is not the time to embark on this project—because of the diversion of materials to armament and defense. This, we submit, may be a specious argument. Those who would use it would—if there were no large defence program—turn around and say, “We cannot now afford to proceed with the project because there is not sufficient money available”.

We have examined reports previously issued on the subject and have paid particular attention to the report which was prepared jointly by the Economics Division, Marketing Service and the Prairie Farm Rehabilitation Branch of the Federal Department of Agriculture.

We would draw attention to the fact that this report was “final” in its tone and a perusal of the information leaves little doubt that the project is feasible. Furthermore, the report clearly enumerates the many advantages to be gained and a reading of it in our opinion, appears to justify the expenditure that will have to be made to complete the work.

In view of the fact that the project would be undertaken by the Federal Government primarily as a means of water conservation, irrigation and a source for urban water supply, there seems to be little doubt as to its need and feasibility. We cannot help but deplore the continued delay and we further deplore what appears to be the use of this proposal, to some degree, for political strategy or expediency. Saskatchewan needs the South Saskatchewan River dam for irrigation purposes. We need it now and any discussions regarding associated or related matters must be considered as supplementary to the main issue.

EXAMINATION

Irrigation Benefits

Notwithstanding the various arguments that have clouded the discussions of the project's feasibility, we reiterate that the main purpose of the project is to supply water for irrigation and land reclamation pur-

poses. While we propose to examine the other fields of development later in this submission, we urge the Commission to bear in mind that irrigation should remain the prime reason for the construction of the dam on the South Saskatchewan River.

Why is this so? To the Saskatchewan farmer and the citizen generally, agricultural stability and security are of prime importance. It is not necessary here to recount the development of this province, the original errors in settlement and the subsequent adjustment to natural and economic conditions. The Commission need only tour the proposed development area to see the evidence. Abandoned farms and schools, run-down buildings, one-room schools, eroded soils, all point to a hazardous and insecure economy. The economic and social records are also easily available from farmers, municipal officials and a whole host of publications which analyse the problems of the area.

While adjustments have taken place either by pressure from economic forces and natural factors or by conscious rehabilitation programs of federal and provincial governments, much remains to be done. There are still thousands of sub-marginal farmers in the province and many hundreds in the proposed development area itself who need more agricultural stability if they are to raise their living standards. It is submitted here that a direct result of the water conservation and irrigation project as outlined in the report prepared by the Federal Department of Agriculture, a large and significant resettlement program could be undertaken and thus greatly assist in solving the problem of insecurity and instability of the many farmers in this area, as well as any new farm units which could be established.

The people of Canada generally are affected by agricultural instability since the nation is by no means immune to the violent fluctuations of the prairie economy. The nation is also vitally concerned with its future food supplies. Traditionally we tend to think of Canada as a food-exporting nation. While this may be true of grains it is submitted that before long we may be forced to import increasing amounts of other food commodities. (This was substantiated in the submission of the Saskatchewan Government to this Commission.) Recent reports by the Dominion Bureau of Statistics indicate a Canadian population of 15 million by 1953, while a comparable increase is expected in the U.S.A. Scarcity of food is a major problem in the world today and with continuing increases in population expected it is doubtful whether the problem will be greatly alleviated in the future.

The only real solution is, therefore, an intensification of the production on our own soil. This means that every feasible irrigation and water conservation project must be fully exploited. It will also be necessary to rely increasingly on fertilizers, better farming methods, better variety of seeds, and more comprehensive weed and insect control.

It is for these two basic reasons, economic stability for agriculture and higher food production, that we need the South Saskatchewan River project now.

STABILIZATION OF AGRICULTURE

Resettlement

The planned irrigation development would provide for the irrigation of some 431,000 acres. Since 1,245 farms are now in the area-dry land, farms with a very low production per acre, it would seem that by increasing potential production it would be feasible to increase the number of farms considerably by resettling farm families now producing under sub-marginal conditions in problem areas. The sub-marginal land thus released could either be sown to grass or incorporated into remaining farms so as to provide a sufficiently large unit for better soil conservation methods and efficient farm management. Thus a far greater number of farmers would be affected by the proposed irrigation project than those actually in the area. The importance of this stabilization in terms of a stable rural society, resource conservation and increased production should not be under-estimated. Direct savings in community relief services alone could total hundreds of thousands of dollars over a period of years, judging by the record of performance of this area over the years.

Feed Supplies

Another aspect of stabilization of agriculture in Saskatchewan is the provision of assured feed supplies for our livestock industry. The citizens of this province have witnessed disastrous decimation of our herds because we simply could not produce sufficient feed in drought periods. Provision of assured fodder supplies through irrigation will not only prevent such disasters but will have a permanent effect on livestock production. Pasture capacity can be increased on the basis of these feed supplies and a complete integration of range and irrigated areas can be developed.

The Saskatchewan Farmers Union submits that a great contribution can be made by the South Saskatchewan River project to the stabilizing of farm conditions in the development area and also, to a great extent, in a large part of the central Saskatchewan area. We feel that without any doubt, the benefits

thus derived would make themselves felt throughout a large part of our western economy. Irrigation in the area could encourage an increase in diversified farming methods with greater regularity in livestock numbers. Increased stocks of feed and fodder would also provide a near-at-home steady supply for livestock herds in other parts of southern and western Saskatchewan.

In addition to the foregoing arguments in support of the project we would like to draw the attention of the Commission to the value to be found in certain supplementary benefits to be found in farming under irrigation conditions. It would appear that home and living amenities associated with irrigated farming are more conducive to keeping people interested in maintaining the family farm and providing greater comforts to improve their own living conditions. We feel that farmers will be encouraged to landscape their home surroundings as well as providing home water and sewerage facilities.

Food Supply

While we cannot predict with certainty what foods the project will eventually produce, it is on the other hand generally accepted that livestock and vegetable products will predominate. It is necessary to ask whether a demand will exist for these products. This question has been examined by the provincial government economists. They find that for a population of 20 millions, which we may expect by 1970 if not earlier, a minimum of an additional 12 million acres will have to come into production of present production, consumption and import levels are maintained. The seriousness of this problem should not escape notice. Canada has no large untapped frontiers of agricultural lands. Scattered parcels of uncertain quality and quantity are available in northern areas but these will not be sufficient for our future food needs. Large-scale import possibilities are equally remote in a hungry world. It is thus becoming obvious that we will be obliged to look to intensified utilization of present land resources for future food supplies. In short, if Canada expects to support a growing industrialized and agricultural population within the next few decades, she must see to it that all feasible irrigation schemes are developed without delay. While irrigation is only a part of a program to increase productivity, it holds forth most promise for increased agricultural production.

Urban and Recreational Water Supply

Although the Saskatchewan Farmers Union is herein mainly concerned with water problems of agri-

culture, it is by no means unaware of the vital needs of cities and recreational areas dependent on plentiful and good water supplies.

In urban centres living amenities, industrial development and city growth are all retarded due to uncertain and insufficient supplies of water. These handicaps obtain in both Regina and Moose Jaw. It has been established that for these cities the only reliable source of water is the South Saskatchewan River and a water supply project is being constructed now to transport South Saskatchewan water. Completion of a dam at Coteau Creek will reduce the capital and operating costs of this project significantly.

The very few lakes on the open plains of the southern part of the province mean lack of recreational areas for our citizens. The South Saskatchewan Project will not only create an immense reservoir but will also permit the maintenance of levels of Last Mountain, Watrous and the Qu'Appelle Valley Lakes.

Hydro-Electric Power

While we reiterate that the main justification for construction of a dam at Coteau Creek lies with irrigation and water conservation benefits, the incidental power possibilities are of considerable significance. However, they are only significant in so far as they are a better alternative to other types of power generation. We submit that no similar choice is available with the agricultural phases.

It has been estimated by P.F.R.A. and the Provincial Government that hydro-power generation on the project offers considerable savings over alternative forms of generation. This in itself is strong justification for support of the project but in addition it should be pointed out that hydro-power utilizes a relatively permanent resource for generation purposes. Other materials such as coal and natural gas may be depleted and have in addition other valuable uses. Finally no other more beneficial use can be made of the vast bulk of South Saskatchewan water than that of power and irrigation.

The provision of large quantities of relatively cheap power can contribute greatly to stability in Saskatchewan agriculture. The province is in the early stages of rural electrification and the promise of cheap power would provide impetus to the program. This means that care should be taken not to load too much of the costs of the project onto power.

CONCLUSION

The Commission has been asked to answer two questions:

1. Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;
2. Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

The Saskatchewan Farmers Union submits that both of these questions can and should be answered in the affirmative.

While we have deliberately refrained from attempting to measure exact benefits arising from the project there should be little question that the investment would be profitable viewing it in the light of a great national project. What is the cost of the project? Measured in dollars and cents on an annual basis it is an almost minute .2% of current capital investment in Canada.

On the positive side it has been convincingly demonstrated, in both the P.F.R.A. and Provincial Government brief that dollars and cents benefits measured either in terms of farm budgets or national income are more than enough to repay the investment. These estimates do not, however, measure the value of stable communities, and human satisfaction. These are intangibles in the monetary sense but are after all the tangible objective of all our efforts.

Then too, are there real and better alternatives to the use of the physical resources involved? In the first place it is quite obvious that irrigation farming is a superior type of land use to dry land farming.

It is further submitted that there is no alternative use of the water involved. A certain amount possibly could be used in Alberta irrigation or Manitoba power production but the vast bulk of the flow has no other use. Furthermore, reports of the Prairie Provinces Water Board and the P.F.R.A. indicate conclusively that maximum use of basin water will be made by constructing the South Saskatchewan River Project.

There are two important resources involved, soil and water and there is little doubt that this project would utilize both resources at an optimum level.

The Saskatchewan Farmers Union urges the Commission to recommend the construction of this project at an early date. Its completion will represent a significant advance in Saskatchewan and Canada.

All of which is respectfully submitted by the Saskatchewan Farmers Union.

**Brief for Presentation to the Royal Commission
on the South Saskatchewan River Project**

WM. F. McLEOD, DILKE.

Gentlemen:

It is not my intention today to burden you with a large body of data that you already have in your possession. A great deal of work and investigation has gone into this project, and all the resulting information is available to you. My interest in appearing before you is to emphasize what I feel are the general considerations which should be borne in mind in assessing the proposed South Saskatchewan Project.

I am myself a farmer, located near Dilke, Saskatchewan. I am not, therefore, located in the irrigable area, but my land is sufficiently close to that area to be vitally affected by the changing production pattern, and social conditions, which will follow from the development of this project. In addition, I occupy the position of Director of the Saskatchewan Wheat Pool, representing District 10, which includes much of the development area. The Saskatchewan Wheat Pool, I should add, is a co-operative grain and livestock marketing organization which includes in its membership most of the farmers of Saskatchewan. I have, therefore, both an interest and a responsibility in expressing what I believe to be the views of a great majority of the farm people in this part of the province.

To the people of Canada, the advantage in a project of this kind lies in the expansion of the nation's agricultural productivity at a time when expanding population is beginning to overtake the land resources of the continent. While large export surpluses of grain are still produced in North America, this is hardly true of the capacity for the production of meat, milk and vegetables. Moreover, the world's real and growing need for this surplus grain is an economic and social fact that must be taken into account.

With population rising in both Canada and the United States at a rate far exceeding recent expectations of statisticians, there is, it seems to me, every reason to take the attitude that intensive efforts to expand food producing capacity must be made and maintained in the years to come.

Taking Saskatchewan alone, there are well-founded prospects of increasing population—population needed to operate and serve the oil and mining industries that are now being developed, and the subsidiary industries that should grow up alongside.

Any project of this kind must be judged in relation to its cost. Making such a judgment is the task of the Commission, and it would be both needless and presumptuous of me to try and suggest to you what your conclusions will be in this regard.

What I can do, however, is to assure you gentlemen that here in central Saskatchewan we take this project very seriously indeed, and in fact base our hopes for our future prosperity and welfare upon it to a great extent.

The South Saskatchewan Project is a long-term one. Ten years will complete only the initial construction (at an optimistic estimate). Ten more years would probably be too little for the program of re-settlement, land improvement, experimentation and adjustments to economic conditions that must follow. Current economic conditions, and past experience, can offer only a partial indication of what may be expected twenty or thirty or fifty years hence.

Some concrete facts can, however, be taken into account. The most important of these facts are:

1. The irrigable area in the proposed development contains a high percentage of soil types eminently suitable for irrigation.

2. These same soils, on the other hand, cannot be expected, by and large, to yield more than very moderate living standards to the people who farm it, even under favourable conditions of dry-land agriculture. Much of this land is, in fact, not really suitable for the permanent growing of cereal grains under dry-land conditions. Periods of low moisture, or of less than ideal economic trends, are disastrous to the living standards of a great many of the people who farm in this area. Actually, less than 10% of the land in the development area is classed as being excellent or good for wheat production.

3. Population in the area is decreasing, causing increasing difficulties in providing educational and municipal services.

4. Livestock numbers are low, with 80% of farms in the area classified as predominantly grain farms. Mixed farming and specialty livestock production play a relatively minor role in the area. This excessive dependence upon grain (wheat alone accounts for 70% of the seeded acreage), makes large fluctuations in income inevitable. On the large areas of sub-marginal and marginal land it makes severe soil deterioration a real threat.

5. In Saskatchewan there are still large numbers of uneconomic farm units—uneconomic both because of inadequate size and unsuitable land. This subject has been dealt with at some length in the Saskatchewan government's preliminary brief to the Commission. The proposed project would provide settlement opportunities for a substantial number of farmers from this and other parts of the province. An increase of 1,500 farmers would be possible in the development area itself, and these 1,500 new farmers would in turn release land which would be available for the expansion to an economic size of many existing farms in other parts of the province.

As I see it, and as I think most interested authorities see it, the main value of the project will be to serve as the basis for a stable and expanded livestock industry. This at least has been the pattern in the Val Marie area of Saskatchewan and in Alberta. As noted previously, livestock numbers in our part of the province are low, resulting in very heavy dependence upon risky cereal cash crops, principally wheat. Under dry land conditions the accumulation of a substantial livestock population in the project area is not feasible. On many farms there is not enough water for livestock. Lack of rainfall makes the growing of grasses and legumes for feed a particularly hazardous undertaking. The livestock grower is in an extremely vulnerable position. If a man does develop a good herd, he is constantly in danger of being forced by severe drought to sell it, or to import feed at prohibitive cost.

Along with thousands of others, I personally was forced in 1937 to sell out my livestock holdings at 1½ cents per pound, because of the lack of feed in that year. Statistics show a sharp drop in livestock numbers during 1937, several hundred thousand in all, and this drop represents a great volume of forced selling caused by drought. For instance, prior to the establishment of the Val Marie irrigation development in southern Saskatchewan, on the 6,000 acres involved, livestock numbers were reduced to a mere 200 head of cattle in 1937. Today, in this same area, there are 4,000. What is more, there is no danger in that area, today, that an investment in livestock which it has taken years to accumulate will be wiped out through lack of feed reserves and a total failure of the crop through drought.

The South Saskatchewan Project would be of sufficient size to add a real element of protection and stability to the livestock industry throughout a very large part of Saskatchewan. I am told that the 6,000 irrigated acres at Val Marie form an integrated production set-up of over an area of 250,000 acres. 430,000

irrigated acres would undoubtedly bring a measure of stability to livestock production over a very large area.

With 430,000 acres of irrigated land, feed could be produced with regularity, and reserves maintained as an important protection against drought. A great many farmers outside of the area would share in the benefits of this protection. Being partly in the nature of insurance, this dependable source of emergency feed reserves would have an effect far greater than might be indicated by the actual productive capacity of the irrigated land.

Another important advantage of the project would be its ability to provide the forage necessary to finish cattle raised in and around the irrigated areas. At the present time only some 5% of the cattle sold through Winnipeg are finished animals. On the other hand, the Vancouver market handles the highest percentage of finished cattle of any city in the Dominion, and Vancouver residents enjoy better meat than the residents of any other Canadian city. This is a direct result of Alberta's irrigation development. The cattle sold through Vancouver are drawn to a great extent from southern Alberta, where the development of irrigation on a large scale has made the production of properly finished cattle possible. The production of increased numbers of finished cattle in Saskatchewan would not only benefit farm people, but would mean better meat for Canadian consumers.

The question arises, of course, as to whether it is economically sound to plan for a major increase in livestock production in western Canada. On this point I would like to quote briefly from the June-July, 1950 issue of the Livestock Letter which is published by the Industrial and Development Council of Canadian Meat Packers. This letter discusses the long-term market prospects for meat, and it makes this statement:

"The process of time, the growth of human populations, and industrial and economic developments are rapidly creating a community of interests between the United States and Canada which did not formerly exist. Conditions in the United States are already almost dominating the marketing of meat animals. It is, therefore, advisable to consider the problems with which we will have to deal as part of the joint U.S. and Canadian picture.... when Canada's relatively small human and animal populations are merged with the United States the combined figures indicate an almost static position (human to animal population ratio, 1936-40 and 1949) for the two countries....while the human population of Canada and the United

States has increased between 1936-40 and 1949 by over 21 million persons the relationship of potential supplies of meat to consuming population has not materially changed."

The Letter then goes on to point out that per capita consumption of meat is a variable factor closely related to consumer income. With improved income the level of per capita meat consumption rose from 116.7 lbs. in 1935 to 143.8 lbs. in 1949. A peak of 155 lbs. was reached in 1947. Keeping in mind the importance of adequate consumer income to a high level of meat consumption, the Letter then states that "from the viewpoint of the future, growth of human population in North America will greatly increase demand for animal production."

The Letter ends this particular article with an extract from a publication of the American Meat Institute, which paints a picture something like this:

The American population is increasing now at the rate of over 2,000,000 each year. By mid-summer of this year (1950) the U.S. population will have doubled in 50 years—from 76,000,000 in 1900 to 152,000,000. It is estimated that every morning approximately 5,500 more people sit down to the breakfast tables of America than there were the previous day—that's 10,000,000 more people by 1955. *"We may, the Institute states, be coming in sight of the time when rising living standards combined with population growth will put pressure on our ability to expand and maintain the needed production of milk and meat."* Today the question is, "Will the American farmer produce enough meat, milk and eggs to meet the needs of the people?"

One bushel of corn or equivalent in other feed grains produces about 6 pounds of meat. On the basis of the present level of meat eaten per person, about 25 bushels of corn or equivalent in other feed grains are needed to produce the meat for every man, woman and child in the U.S. during the year. This is in addition to the feed required to produce the milk, eggs and other livestock products. At this rate about 500,000,000 bushels of corn or feed equivalent will be needed in another ten years to produce the meat for the increased number of people, if the U.S. population is to eat as well as they do at present.

On the present basis of diet the average civilian in the United States consumes 380 eggs, 25 to 30 lbs. of poultry, about 150 lbs. of beef, pork, veal and lamb and 750 lbs. of milk each year. If

Americans continue to eat at this level and there is a 10 million increase in population by 1955, at present levels of production there will be a need for 25,000,000 more hens, 23,000,000 more broilers, 2,700,000 turkeys, 5,000,000 more hogs, 6,250,000 more beef cattle and 1,500,000 more dairy cattle just to feed the increase in population. The Institute comments, "Add to this the number of animals and poultry needed to feed the present population and it's easy to see the potential need for more livestock and poultry production."

It should be added to this that Canadian and American population increases are both proving to be ahead of most statistical forecasts. It seems to me that this single consideration—of increasing pressure on the livestock producing resources of the continent, provides ample justification for proceeding with the South Saskatchewan Project, provided that the cost is within reason. To double or triple the productivity of 430,000 to 500,000 acres of land, and at the same time add an element of stability of feed supplies which can substantially boost the whole provincial livestock potential seems to me a very worthy object.

I would like to close by emphasizing again my own belief that there is every reason to take the general attitude that the expansion of this nation's agricultural resources is not only desirable but may very possibly become a pressing need in the not too distant future. The South Saskatchewan Project would, when completed, result in a substantial increase in food-producing potential, and its desirability must be viewed from a long-term point of view.

Moreover, by undertaking this development, an insecure economy that from time to time requires financial assistance, as P.F.A.A. payments or in other forms, would be given security and stability, with a measurable financial gain to the nation as a whole, as well as great but unmeasurable benefits in the form of healthy rural communities, increased food production, rural electrification and vastly improved recreational facilities for an area badly in need of them. Some of these important aspects of the Project I am merely mentioning. They will doubtless be brought forcibly to the attention of the Commission by many interested persons.

May I close by thanking you for your attention. I trust that you will give the considerations which I have emphasized here your most serious attention.

Brief of the 18 Rural Municipalities in the Development Area to the Royal Commission on the South Saskatchewan River Development

MR. C. O. COOPER

Mr. Chairman and Gentlemen:

The announcement by the Federal Government that it would be necessary for a Royal Commission to further investigate the feasibility of the South Saskatchewan River project before the work could proceed was a matter of keen disappointment to the 18 Rural Municipalities located in the development area. It is our opinion that sufficient evidence and technical data has been accumulated to fully justify the Government proceeding with construction.

While this disappointment has been manifest on all sides we recognize that the Royal Commission is now an accomplished fact and it is our desire to co-operate and assist the Commission in every way so it may successfully complete its work at the earliest possible date. We would urge the Government to seriously consider inaugurating the initial work on the project without further delay.

Population Statistics

The development-area Rural Municipalities have viewed with alarm the continued and serious decline of population throughout Saskatchewan, which we feel could be arrested to a considerable degree by the economic and social adjustment that would naturally result from cheap electricity for industrial and rural use.

We have been especially alarmed at the particular decline in population as it has affected our 18 municipalities located within the proposed development area. We would respectfully point out to the Commission that in 1926 these 18 municipalities had a rural population of 31,672. In 1951 the population had declined to 18,297.

In 1926 the population averaged 5.28 persons per square mile. In 1951 this figure had decreased to 3.5 persons per square mile. (In calculating these data we used the approximate figure of 6,000 square miles as the area of the 18 municipalities, assuming a total of 165 townships with 36 square miles per township.)

Table No. 1 gives detailed information on rural and urban populations for the census years 1926 to 1951 inclusive.

Cost of Project

It is the considered opinion of our 18 rural municipalities that statements regarding the expenditure necessary to build the project are often misleading and unrelated to actual facts.

It is our contention that this project can readily pay for itself by

- (a) increasing production through irrigation.
- (b) increasing settlement in the development area.
- (c) developing cheaper abundant electricity for a large portion of the Province.
- (d) lessening the need for P.F.A.A. assistance.

With regard to the latter point we feel that the savings to the P.F.A.A. alone would, in the course of a few years, almost pay for the building of the dam. It would be well if we were to examine P.F.A.A. figures from 1939 to 1950 to give us an idea of what the expenditure has been in the 18 municipalities coming within the development area. Table No. 2 gives this information in detail.

Irrigation in Practice

Our municipalities feel that a comparison of the proposed development area can be made with the Lethbridge area of Alberta. By climate, and nature of soil conditions, there is a marked similarity. It is further worthy of note that the irrigated area around Lethbridge constitutes roughly the same general acreage as that in the irrigable portion of the South Saskatchewan River Development Area.

We would further point out that the Lethbridge area is now maintaining an average of about 29 people per square mile while the proposed development area in Saskatchewan has only 3.5 persons per square mile.

Figures with regard to the South Alberta census, taken from the Lethbridge *Herald* of October, 1951, show that while the towns and villages all showed some considerable growth the population of the dry land wheat areas fell off slightly. On the other hand, irrigated districts showed a considerable increase in population due to the creation of new farms under the ditch and the growth of industries based upon irrigated farm products. Census District No. 2, surrounding Lethbridge, grew by 12,780 to 71,343 adding very considerably to the trade in the territory. Lethbridge's wholesale trade territory now stands at well over 125,000 persons.

Local Projects

In the Rural Municipality of Rosedale No. 283, we have several small projects in operation. We would like to draw your attention to two of these as an example of what can be expected from the development of irrigation.

One farmer, who farms 1½ sections of land had 500 acres of wheat from which he harvested about 1,200 bushels in the fall of 1950, while on his water

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project of 40 acres he harvested 1,800 bushels of oats and stacked 9 loads of oat sheaves for fodder. This farmer is situated in the centre of a two township area which invariably receives the dried out bonus, and 1950 was no exception.

Another irrigation project in operation for the past two years showed a large increase in production. The farmer threshed over 3,000 bushels of barley on 65 acres. The barley was cut with a binder and threshed to assure the farmer of grain and rough feed for his herd of pure-bred Shorthorn cattle. His wheat on this project averaged 15 bushels to the acre higher than that on his dry land.

It is our opinion that this Commission should view this information in the light of general conditions that have prevailed in the Rosedale Municipality during the past year: Some figures in this connection are given below.

AGRICULTURAL AID GIVEN

1932.....	\$ 6,466.32
1933.....	29,054.32
1934.....	26,711.97
1935.....	32,456.43
1936.....	16,337.42
1937.....	20,429.61
1938.....	104,152.69
1938 (twine and rep.)	5,487.57
1939.....	2,692.13
1940.....	272.97
1941.....	192.28
1942.....	214.84
1943.....	133.34
1946.....	120.00
1950.....	3,904.25

\$ 248,626.14

Approximately 320 farmers received aid in 1937-38. The average yield of wheat in the R.M. of Rosedale No. 283 for the years 1931 to 1950 inclusive was 6 bushels to the acre. P.F.A.A. assistance was paid throughout 8 years of the 10 year period of operation. During the worst drought period of the 1930's approximately 99% of the Rosedale population was on relief.

The topography of Rosedale is more suited to mixed farming than grain. However, this is hampered greatly by a continual shortage of water and pasture.

In the past 20 years the number of farmers in the 10 townships in Rosedale municipality decreased by approximately 100 separate units and a much greater number in population.

Conclusion

Eighteen Rural Municipalities in the development area feel that justification for the construction of the South Saskatchewan river project has been fully established by previous investigation, and will, we trust, be borne out by this Commission. In view of the benefits that will be derived by the general public we submit that the Government of Canada should take steps to guarantee that work begin at once, as we feel that in central Saskatchewan irrigation is our only salvation.

All of which is respectfully submitted this 17th day of July, 1952.

Signed for and on behalf of those municipalities listed below who have endorsed this brief:

C. O. COOPER.

ENDORSEMENTS

The Rural Municipality of Montrose No. 315 endorses this brief, of which this endorsement becomes a part thereof.

Signed on behalf of the council of the R.M. of Montrose No. 315.

[Seal] D. T. SHANNON,
Reeve.

The Rural Municipality of Vanscoy, No. 345, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Vanscoy, No. 345.

(Signed) G. C. LENSEN,
[Seal] Reeve.

Dated this 8th day of July, 1952.

The Rural Municipality of Cory No. 344, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Cory No. 344.

(Signed) H. H. SOMMERFELD,
[Seal] Reeve.

Dated this 23rd day of June, 1952.

The Rural Municipality of Willner, No. 253, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Willner, No. 253.

(Signed) C. H. LICK,
Reeve.

[Seal]

Alfred T. Spratt
J. Alex Constable
Peter Doell
P. F. Commer
I. Ames
Frank Bender

Councillors

G. BYGRAVE,
Secretary-Treasurer.

Dated this 10th day of May, 1952.

The Rural Municipality of Canaan, No. 225, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Canaan, No. 225.

(Signed) H. S. BUNESS,
Reeve.

[Seal]

Dated this 3rd day of May, 1952.

The Rural Municipality of Rosedale, No. 283, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Rosedale, No. 283,

(Signed) C. O. COOPER,
Reeve.

[Seal]

Dated this 6th day of May, 1952.

The Rural Municipality of Coteau, No. 255, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Coteau, No. 255.

(Signed) R. J. FOXCROFT,
Reeve.

[Seal]

Dated this 5th day of May, 1952.

The Rural Municipality of Dundurn, No. 314, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Dundurn, No. 314.

(Signed) E. R. SCHWANBECK,
Reeve.

[Seal]

Dated this 5th day of May, 1952.

The Rural Municipality of Lost River, No. 313, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Lost River, No. 313,

(Signed) O. J. FROST,
Reeve.

[Seal]

Dated this 29th day of April, 1952.

The Rural Municipality of Maple Bush, No. 224, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Maple Bush, No. 224.

(Signed) C. E. CALDWELL,
Reeve.

[Seal]

Dated this 3rd day of May, 1952.

The Rural Municipality of Loreburn, No. 254, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Loreburn, No. 254.

(Signed) W. A. NORRISH,
Reeve.

[Seal]

Dated this 19th day of April, 1952.

The Rural Municipality of Fertile Valley, No. 285, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Fertile Valley, No. 285.

(Signed) J. S. WELDON,
Reeve.

[Seal]

Dated this 21st day of April, 1952.

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The Rural Municipality of Eagle Creek, No. 376, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Eagle Creek, No. 376,

(Signed) P. J. NESTRANSKY,

[Seal]

Reeve.

Dated this 3rd day of May, 1952.

The Rural Municipality of Rudy, No. 284, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Rudy, No. 284.

(Signed) J. HARRINGTON,

[Seal]

Reeve.

Dated this 29th day of May, 1952.

The Rural Municipality of Huron, No. 223, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Huron, No. 223.

(Signed) C. W. WILSON,

[Seal]

Reeve,

Dated this 10th day of June, 1952

The Rural Municipality of Blucher, No. 343, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Blucher, No. 343.

(Signed) E. G. BALDWIN,

[Seal]

Reeve,

Dated this 2nd day of June, 1952

The Rural Municipality of Perdue, No. 346, endorse this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Perdue, No. 346.

(Signed) J. D. MILLER,

[Seal]

Reeve,

Dated this 7th day of July, 1952

The Rural Municipality of Park, No. 375, endorses this brief, of which this endorsement hereby becomes a part.

For, and on behalf of the Council of the Rural Municipality of Park, No. 375.

(Signed) J. J. WURTZ,

[Seal]

Reeve,

Dated this 14th day of July, 1952

TABLE 1
Population Statistics

R.M.	—	1926	1931	1936	1941	1946	1951
223	Huron.....R. U.	1,307 303	1,201 234	832 206	843 236	750 243	612 186
	T.	1,610	1,435	1,038	1,079	993	798
224	Maple Bush R. U.	1,499 378	1,562 412	1,161 323	938 369	817 323	664 292
	T.	1,877	1,974	1,484	1,307	1,140	956
225	Canaan.....R. U.	958 196	1,100 291	853 280	727 268	617 309	458 344
	T.	1,154	1,391	1,133	995	926	802
253	Wilner.....R. U.	1,284	1,284	996	973	741	745
	T.	1,284	1,284	996	973	741	745
254	Loreburn...R. U.	2,399 858	2,323 838	1,579 581	1,446 630	1,265 748	1,078 730
	T.	3,257	3,161	2,160	2,076	2,013	1,808
255	Coteau.....R. U.	1,628 272	1,739 318	1,444 229	1,218 234	944 275	879 265
	T.	1,900	2,057	1,673	1,452	1,219	1,144
283	Rosedale...R. U.	1,789 368	1,683 362	1,385 287	1,205 380	1,040 359	881 358
	T.	2,157	2,045	1,672	1,585	1,399	1,239
284	Rudy.....R. U.	1,918 881	1,940 975	1,548 833	1,415 728	1,129 834	870 896
	T.	2,799	2,915	2,381	2,143	1,963	1,766
285	Fertile Valley....R. U.	2,383 698	2,270 687	2,034 508	1,678 525	1,327 518	1,156 549
	T.	3,081	2,957	2,542	2,203	1,845	1,705

TABLE 1 (cont.)

R.M.	—	1926	1931	1936	1941	1946	1951
313	Lost River R. U.	1,241	1,271	1,159	1,032	910	725
	T.	1,241	1,271	1,159	1,032	910	725
314	Dundurn... R. U.	1,244 231	1,343 280	1,498 257	1,056 344	844 343	767 298
	T.	1,475	1,623	1,755	1,400	1,187	1,065
315	Montrose... R. U.	1,450 50	1,434 62	1,162 46	1,022 42	839 34	767 45
	T.	1,500	1,496	1,208	1,064	873	812
343	Blucher... R. U.	1,965 633	1,953 600	1,853 573	1,672 616	1,386 623	1,178 550
	T.	2,598	2,553	2,426	2,288	2,009	1,728
344	Cory..... R. U.	2,502 32,244	2,923 44,439	2,464 42,676	2,307 43,915	2,053 47,074	2,751 54,597
	T.	34,746	47,362	45,140	46,222	49,127	57,348

TABLE 1 (cont.)

R.M.	—	1926	1931	1936	1941	1946	1951
345	Vanscoy... R. U.	2,133 753	2,089 752	1,890 663	1,684 664	1,410 699	1,057 775
	T.	2,886	2,841	2,553	2,348	2,109	1,832
346	Perdue.... R. U.	1,833 629	1,718 528	1,625 452	1,348 463	1,041 497	906 553
	T.	2,462	2,246	2,077	1,811	1,538	1,459
375	Park..... R. U.	2,155 416	2,212 412	2,170 390	1,850 318	1,676 311	1,261 305
	T.	2,571	2,624	2,560	2,168	1,987	1,566
376	Eagle Creek... R. U.	1,984	2,284	2,334	2,109	1,725 108	1,542
	T.	1,984	2,284	2,334	2,109	1,833	1,542
	Total—Rural...	31,672	32,329	27,987	24,523	20,514	18,297
	Urban...	38,910	51,190	48,304	49,732	53,294	60,743
	Area...	70,582	83,519	76,291	74,255	74,808	79,040

TABLE 2
Prairie Farm Assistance Act

R.M.	P.F.A.A. Farmers	1939 Payments	P.F.A.A. Farmers	1940 Payments	P.F.A.A. Farmers	1941 Payments	P.F.A.A. Farmers	1943 Payments
		\$ cts.		\$ cts.		\$ cts.		\$ cts.
223.....	93	11,957 80	179	22,706 30	229	68,449 78	28	5,103 00
224.....	77	11,495 00	268	48,142 95	314	116,861 12	.....	.....
225.....	26	3,837 50	176	30,783 38	201	77,289 41	114	24,811 50
253.....	30	3,911 50	189	36,954 86	275	107,542 19	.....	.....
254.....	.....	.....	369	81,861 37	419	137,796 70	.....	.....
255.....	.....	.....	247	35,958 07	301	84,278 04	.....	.....
283.....	20	2,278 00	97	18,567 17	345	136,414 88	58	14,116 50
284.....	13	1,529 50	331	67,352 51	461	158,862 22	18	3,354 00
285.....	.....	.....	39	3,719 25	376	137,655 45	.....	.....
313.....	42	5,910 50	114	12,583 80	234	63,535 46	.....	.....
314.....	70	11,917 35	87	7,454 70	210	47,030 14	52	8,513 25
315.....	25	1,290 50	11	468 45	233	55,843 95	85	12,822 59
343.....	47	6,363 50	112	14,222 70	365	114,340 13	.....	.....
344.....	77	8,806 90	86	10,159 20	376	85,259 23	80	13,173 75
345.....	.....	.....	.....	.....	407	80,693 07	143	33,160 31
346.....	.....	.....	.....	.....	339	54,606 60	189	47,093 41
375.....	85	6,636 00	83	5,655 60	432	53,664 00	376	62,289 50
376.....	41	3,665 25	360	35,753 68	351	79,838 96
Totals.....	605	75,934 05	2,429	400,255 46	5,877	1,615,876 05	1,494	304,276 77

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TABLE 2 (cont.)

R.M.	P.F.A.A. Farmers	1944 Payments	P.F.A.A. Farmers	1945 Payments	P.F.A.A. Farmers	1946 Payments	P.F.A.A. Farmers	1947 Payments
		\$ cts.		\$ cts.		\$ cts.		\$ cts.
223.....			136	32,548 46	161	34,513 00	209	48,488 25
224.....			282	76,859 67	138	25,997 25	281	74,217 50
225.....			183	75,375 29			192	47,448 00
253.....			125	27,741 75	279	77,787 60	214	52,395 00
254.....			44	10,560 00	122	27,438 23	424	134,036 50
255.....			204	48,976 74			219	45,039 00
283.....			193	47,811 75	308	82,284 24	345	152,015 00
284.....			327	74,850 52	359	90,254 65	448	122,928 75
285.....			343	84,848 97	116	26,622 00	329	74,560 50
313.....			80	18,046 50	51	9,900 00	236	83,891 55
314.....			85	20,934 65	88	22,254 04	202	49,979 75
315.....			228	63,332 68	230	54,638 88	243	59,615 00
343.....			296	69,695 25	289	65,296 09	359	132,557 00
344.....			313	61,066 93	143	26,032 00	352	71,226 00
345.....			378	112,104 89	358	77,676 42	403	103,791 00
346.....			350	108,488 90	292	68,831 96	355	134,081 25
375.....			377	70,033 07	355	61,317 25	422	126,832 95
376.....			422	126,479 68	372	84,774 58	436	162,179 65
Totals.....			4,366	1,129,755 70	3,661	835,618 19	5,669	1,675,282 65

TABLE 2 (cont.)

R.M.	P.F.A.A. Farmers	1948 Payments	P.F.A.A. Farmers	1949 Payments	P.F.A.A. Farmers	1950 Payments
		\$ cts.		\$ cts.		\$ cts.
223.....	246	91,068 75	240	99,943 75	237	64,054 50
224.....	315	125,106 75	315	127,979 25	318	116,668 25
225.....	198	70,603 75	149	65,112 50	142	63,432 00
253.....	306	86,305 50	306	127,028 75	294	77,164 50
254.....	452	169,672 55	458	189,688 50	454	112,353 75
255.....	272	102,111 75	279	109,133 75	237	61,013 00
283.....	328	137,941 75	356	157,085 00	331	101,873 50
284.....	448	151,177 50	370	104,628 25	318	74,547 75
385.....	352	108,272 95	235	57,292 25	66	75,411 75
313.....	212	64,346 75	245	79,511 75	244	57,136 50
314.....	203	55,577 00	255	79,786 35	12	2,304 75
315.....	239	92,621 00	173	39,164 40		
343.....	371	109,806 75	324	73,089 75	117	25,497 75
344.....	348	78,504 25	282	58,717 50		
345.....	399	124,712 75	350	78,049 50		
346.....	291	67,600 50	131	29,407 50		
375.....	426	99,559 25	257	52,036 25		
376.....	309	58,884 00	60	12,720 00		
Totals.....	5,715	1,793,873 50	4,785	1,540,375 00	2,770	831,453 00

TOTAL OF PAYMENTS IN THE DEVELOPMENT AREA.....\$ 10,202,705 37

NUMBER OF PAYMENTS.....37,371 00

A Submission of the City of Regina to the Royal Commission Investigating the South Saskatchewan River Development

Ald. L. H. HAMMOND

Gentlemen:

The Mayor and Council of the City of Regina, wish to place on record on behalf of the citizens they represent, their interest in and support of the proposed South Saskatchewan River development project.

The general economic stability which such a project will assist in giving to Saskatchewan will no doubt be developed by organizations interested in the overall aspects of the works. The City of Regina will confine its remarks to specific benefits to this community. In fact, in the interests of brevity and non-repetition, only two matters will be discussed. These two items, however, are ones that vitally concern this community.

This city, in common with southern Saskatchewan, at present as in the past, is dependent for its growth and economic welfare to a very large extent on the fortunes of the wheat farmer. It is common knowledge that as the farmer goes, so go the cities in this section of the province. This fact was demonstrated in the decade of the 1930's. The succession of crop failures caused by the severe and continuing drought which left the farmer with little or no income, was reflected almost immediately in the affairs of the city. With the restricted sources of revenue available to a municipality, it is difficult enough to carry out the normal functions of that level of government. However, with those sources gradually shrinking as incomes become lower or completely disappear, coupled with the tremendous burden of responsibility for the very livelihood of thousands of the residents, the result can only be crippling and disastrous. This applies not only to the current year, but for many to follow. It is recognized that all municipalities suffered a setback in the depression years, but it is doubtful if any were subjected to such a strain on its financial structure as experienced by this city.

For five out of the nine years, it can be seen that one-fifth of the population of this city was not self-supporting. Added to that, of course, was the fact that many more barely provided for day-to-day living and were unable to fulfil their municipal tax obligations. For instance, in 1935, the peak year so far as numbers receiving aid is concerned, less than 60 per cent of the tax levy was collected, and the total revenues to the city were only \$3,351,460. Obviously, therefore, it was necessary to supplement current revenues, which

was done by issue of debentures. This in turn has burdened the city's finances for many years after the debt was created.

The following table sets out the figures for providing relief in the City of Regina from 1931 to 1939 inclusive:

Year	Population	Number of persons receiving social aid assistance	Cost of that social aid to the city
			\$
1931.....	53,209	5,963	373,149
1932.....		8,786	530,371
1933.....		9,615	863,569
1934.....		10,348	1,190,043
1935.....		10,993	1,219,459
1936.....	53,354	10,872	1,319,791
1937.....		10,595	1,378,036
1938.....		10,267	1,388,283
1939.....		8,575	1,138,926

Add \$777,000.00 for medical relief for the nine year period.

The table also points up the fact, that Regina continued to suffer for some years after the world economic situation had returned to a degree of normalcy. This was due to the continuation of the drought and abnormal crop production. In other areas where a more diversified economy prevailed, the return to more buoyant incomes for the individuals was very much swifter. If one may take the Financial Post Business Year Book as a reasonable authority, it will be noted the City of Lethbridge which enjoyed the benefits derived from irrigated soil, did not suffer as did Regina, and furthermore, rebounded very rapidly. For instance, in Lethbridge in 1931 the total production from manufactured products was valued at \$2,335,000, in 1935 it was approximately the same, by 1937 it had increased by 20 per cent, and held that gain through 1939; whereas in Regina, the value placed on such products in 1931 was \$18,061,000, but in 1935 it had decreased to \$8,867,000, in 1937 it was still 33 per cent below 1931 and even by 1939 was a million dollars below the 1931 figure. If automobiles can be used as any kind of index, in Lethbridge registrations in 1939 were 12 per cent higher than in 1931. In Regina, the 1939 figure indicates registrations were 10 per cent lower than in 1931. One must conclude then, that irrigation is a real factor in rendering more stable the community income.

It is realized, of course, that one cannot draw an exact parallel between the two cities, but surely it is a reasonable assumption that irrigation, as it would be made possible by the South Saskatchewan River development, will to a very great degree, diversify and stabilize the present hazardous one-crop gamble. One must also assume that other industries will be attracted to such a district, and that the aggregate of all this must be a brighter outlook for those urban municipalities within and bordering the area, should nature once more become perverse.

Due to the tremendous burden carried by the municipality in the '30's, our citizens are still suffering from the lack of amenities which one normally associates with urban dwelling, and any possibility of such a load again being placed on our financial structure would be viewed with alarm. From this aspect, therefore, the citizens of this City would welcome an early decision of the Government of Canada to proceed with the project.

A matter of paramount importance in the life of this community is the supply of water. From the commencement of our waterworks scheme, this necessity has been obtained from underground wells. The hazards of such a supply have been recognized for years and surveys by our own staff and other experts have always pointed to only one practical source of surface supply—the South Saskatchewan River either directly or by the Qu'Appelle Valley. In this valley is found Buffalo Pound Lake, a natural storage basin which is so located that both the cities of Moose Jaw and Regina may take advantage of its water. Studies showed, however, that this basin in its natural state, could not impound sufficient water, nor were its normal sources of supply adequate, if it was to be used as the sole source of supply for the two cities. In fact, it was insufficient for Regina's use alone if the present wells had to be abandoned. In 1950 a decision was made to proceed with the Buffalo Pound Lake project as the source of Regina's water supply and the Government of Canada was requested to grant what assistance it could. On May 29th of that year, the Minister of Resources and Development communicated to the Premier of Saskatchewan that he had been authorized to inform the Premier that if the City of Regina, or any other city, and the Government of Saskatchewan could work out a satisfactory arrangement for making use of the water in this lake and would take steps to that end, the Federal Government would undertake a project designed to maintain an adequate supply of water in Buffalo Pound Lake. With this assurance, a satisfactory arrangement has been worked out between the Government of Saskatchewan, and the cities of Regina

and Moose Jaw. The net result is that the City of Regina has now embarked on a scheme at an estimated cost to it of \$5,500,000 to purify and pump water from Buffalo Pound Lake to this city.

One of the large factors involved in the ultimate success of the scheme is the assured supply of water in Buffalo Pound Lake. The supplementary source of water to maintain this level is the South Saskatchewan River where it is planned to pump water over a height of land into the natural canal of the Qu'Appelle River. If the South Saskatchewan River development project is completed as now planned, this pumping will be unnecessary as the water level will be raised to such an extent that the water of the river can be diverted into the Qu'Appelle Valley and Buffalo Pound Lake by natural gravity flow.

The Prairie Farm Rehabilitation Act office has been charged with the responsibility of fulfilling the Federal Government's commitment and thus with this pumping problem. Their present estimate of the capital cost of carrying out the work is \$1,170,000. It has been suggested that if the City of Regina keeps its present sources of water supply in operation to supplement the natural inflow to Buffalo Pound Lake until water can be diverted from the South Saskatchewan River by gravity, and thereby be prepared to tolerate the possibility of a shortage, the savings to Canada would be the total of the capital cost of the pumping project. No one, of course, is prepared to make such a decision at this time. The fact remains, consideration cannot be given to such a question until the South Saskatchewan River development project is commenced.

One thing is known. The estimated yearly cost of operating the pumping project by the Government of Canada is \$60,000 per year until 1970, \$75,000 per year from 1970 to 1980, and \$90,000 per year thereafter. These yearly savings will very definitely be made when the project is completed.

There are other benefits which will be derived from the project so far as Buffalo Pound Lake is concerned. A pumping plant to raise water from the South Saskatchewan River into the Qu'Appelle Valley will be subject to all the vagaries of mechanical interruptions, including electrical failures. The canal at the head of the Qu'Appelle Valley between the river and Buffalo Pound Lake, is known to be a difficult one for the flow of a small stream owing to its sandy and porous nature. It is anticipated difficulty might be experienced in obtaining water at the lake from the river without a very great loss in volume. Large quantities of water available by natural gravity flow, such as anticipated as the result of the South Saskatchewan River develop-

ment, would overcome all these possibilities and provide the real solution for an assured supply of water for the cities of Regina and Moose Jaw and other municipalities who might participate in the Buffalo Pound Lake project.

Another benefit accruing to the City of Regina from the large potential supply to be stored in the proposed dam, is the quality of water which would be diverted to Buffalo Pound Lake. With a large head available at the dam, Buffalo Pound Lake could be flushed out periodically thereby eliminating its present stagnancy, and with a consequent drop in algae content. This would have the immediate effect of reducing the cost of treatment. The present estimated cost of chemicals for treatment of Buffalo Pound Lake water is \$52 per million gallons. The exact saving cannot be computed with any degree of accuracy, but it is known that in Saskatoon where Saskatchewan River water is used, the cost of chemicals for treatment is approximately \$7 per million gallons. It is expected that a very considerable amount of the difference between these two figures would be saved by the City of Regina.

The quality of water would also have a very material effect on the amount which could be treated with present equipment. It is estimated if six million gallons per day is the maximum which can be treated when the plant commences operation using Buffalo Pound Lake water, at least two million gallons per day more could be treated of the purer water diverted by natural gravity means from the South Saskatchewan River. This additional output would be very welcome when it became necessary to use Buffalo Pound Lake as the sole source of supply for this city, and could postpone for some time further capital outlays to expand the treatment plant.

It can be seen, therefore, that every citizen in this city is keenly interested in the South Saskatchewan River development from the standpoint alone of his own water supply.

The two arguments developed in this submission may be minor in comparison to the very substantial benefits which can be expected for many people if the project is completed. It is our belief, however, that they are sufficient to indicate to the Government of Canada that the more than seventy thousand citizens of this city are wholeheartedly in favour of the commencement of the South Saskatchewan River development project at the earliest date possible, and its subsequent completion without undue delay.

Submission of the Regina Chamber of Commerce to the Royal Commission Investigating the Proposed South Saskatchewan River Development

MR. ALEX AITKEN

Gentlemen:—

The Regina Chamber of Commerce, representing the commercial, industrial, and professional community of Regina, is vitally interested in the proposal to dam the South Saskatchewan River for irrigation, power, and domestic water supplies.

We realize that Regina is a considerable distance from the area which will be developed. None of the water conserved is to be applied to the Regina plains. Nevertheless we recognize that Regina is in the Palliser Triangle, and that farming—even in these fertile plains, is subject to great variations. The long range average wheat production for the Regina district is only 13·8 bushels per acre.

Agriculture is our basic industry, and we are constantly conscious of its insecurity because of droughth and other factors. We believe that an area of assured productivity in any part of this province would be in the interest of all.

Regina is fundamentally a distributing centre. Retail and wholesale volume is in the neighborhood of 250 million dollars annually. In doing this amount of business, Regina serves a wide area.

For some lines, such as the mail order and general store business, it is the entire province. For other lines, such as drugs and machinery, the area of distribution is the south half of the more heavily populated area of the province. Regina is undoubtedly one of the biggest centres for the distribution of farm machinery in the world, but in the final analysis all Regina business is directly dependent on farm purchasing power.

We do not believe it is possible to make a breakdown of the economic value of a dam on the South Saskatchewan River to Regina's trading area. We do not have figures on the volume of business coming from that area now, nor are we equipped with staff or facilities to analyze the changes irrigation would make such as: The increased number of people that would live in the area; the increase in the volume of production, the increase in the value of that production; the increased purchasing power that would be created; and other factors.

However, we can draw some conclusions regarding those changes by the observations of those with experience. The booklet "More Green Acres" published by

the Lethbridge Chamber of Commerce describes the development of new irrigated areas in that area in the following words:

"All will be self-supporting, and as they establish themselves they will spend large sums to buy all the things they need. Thus the demand for building supplies, home equipment, and farm machinery, clothing, and hundreds of other items will be sharply increased. *This obviously means greater prosperity for business and industry far or near, until the whole national economy will feel the benefit.*" (Italics by the Chamber of Commerce.)

The ramifications of the business arising from irrigation are apparently too extensive and too complex to be easily traced or analyzed. We do not for a moment conclude that benefits in the Saskatchewan River Development area would all accrue or mainly accrue to Regina. Regina is competition for other urban centres. However, the Regina Chamber of Commerce believes that benefits from development to any rural or urban area in the province accrues to all other competing areas. The Regina Chamber of Commerce is convinced that Regina as a trading centre would benefit materially and substantially by the proposed irrigation scheme.

Though basically a distributing centre, Regina has an industrial volume of approximately \$50,000,000 annually with about 3,000 of its citizens finding employment and a livelihood in industrial activities. To some extent these industries are processing agricultural products at present. These are mainly confined to bakeries, creameries, and meat packing establishments.

The Regina Chamber believes that a greater degree of secondary industries would add balance to the city's economy. The combination of drought and depression decreased Saskatchewan's income by 74 per cent. This is partly the result of $\frac{9}{10}$ of Saskatchewan's population being dependent upon one crop.

The Regina Chamber of Commerce has long advocated a greater degree of diversification and decentralization of industry in Canada. Saskatchewan has but 1.8 per cent of the industrial production of Canada, and the people of the province represented by the Chamber of Commerce movement are of the opinion that Saskatchewan has not received a fair share of defence contracts.

There are no doubt fundamental reasons for this situation. We have lacked the basic industries in which to build new products to meet new situations. A diversification of at least a part of our economy, we believe, would help to correct that situation.

This correction can be made in a substantial part by the Saskatchewan River Development project.

Added population will provide new markets. New products will bring new industries. Lack of adequate supplies of water and cheap power which has hampered industrial growth will be removed to a substantial degree for part of the province at least.

Regina has capacity in meat packing and creameries for an increasing supply of livestock and dairy products. There is not enough raw milk production in its immediate area to supply the population of the city. We hope that the development of the South Saskatchewan will bring an intensification and diversification of agriculture in the Qu'Appelle Valley that will correct this situation.

Again we find it difficult, if not impossible, to put a dollars and cents value on the contribution that the development of the South Saskatchewan would make to the industrialization of that area, and directly or indirectly to Regina. We do not have the data on the products that could be grown suitable for processing. We do know, however, that we are very dependent on distant outside sources for some of our common supplies.

For instance, 80 per cent of our groceries is imported, 95 per cent of our fruit and vegetables is imported, 85 per cent of our clothing is imported, 100 per cent of our fine footwear is imported. Obviously, Regina will have to continue to import many commodities. We believe that some of the above lines can be produced and processed within the province and eliminate some of the costs of transportation involved in bringing these products from great distances.

With the exploration for oil and gas in the province and the promise which this has already brought, we consider the time is propitious for the South Saskatchewan Development because it brings a combination of water, power, and gas for industry. Here we could again quote from the Lethbridge area, which points out that the digging of ditches and the building of dams is not the whole story, for that story includes the growth of industry and the increasing prosperity of the whole community.

In summary and conclusion may we quote from the Economic Review for Saskatchewan for June, 1952, as follows:

"For economic security in the long run, two things are essential: A more stable base for agriculture, and a greater diversification of industry."

We recognize that the South Saskatchewan River Development project cannot make for complete security for a whole province. We do believe, however, that that development will make a major contribution to that security.

We believe that the summary report by the P.F.R.A. on the South Saskatchewan Development on this point is a very conservative one wherein it reads on page 2:

"It may be assumed that in full development there would be more than twice the number of farms in the areas than exist today, producing as much as two-and-one-half times the volume of produce, and supporting nearly three times the present population; but possibly of more importance would be the creation of more diversity of interests and stability of enterprise than have hitherto existed, the incidence of which will go beyond the development area."

These estimates seem very conservative when compared with the figures quoted in "More Green Acres" in describing the Southern Alberta experience. Though the area to be irrigated is not ranching, it is sparsely settled and similar in some respects to ranching country. The quotation is as follows:

"Referring specifically to the new development in Southern Alberta, sparsely settled areas now used for grazing cattle will be divided into comparatively small holdings devoted to row crops, cereals, dairying, and livestock feeding. As a result, the density of population will increase from two or three persons per square mile to more than thirty."

The Chamber of Commerce has not attempted to supply figures on the direct benefits of the South Saskatchewan River project. We believe that such figures will come from more competent authorities than we.

We have emphasized the importance of indirect benefits to our city and to the province, the interests of both being entirely intermingled. These indirect benefits are considered by some to be greater than the direct benefits.

The Honourable C. D. Howe suggested this relatively greater importance in a speech at Lethbridge in 1946 when he said:

"Any analysis of the benefits of irrigation must make it apparent that its benefits accrue to the state, and to the community serving the irrigated area, *perhaps to a greater degree than to the individual farmer*. Greater density of farming populations benefits the municipality that serves the area, and greater volume and greater value of crop production benefits both the province and the Dominion." (Italics by Chamber of Commerce.)

Some go far beyond the Honourable Minister in appraising the relative importance of direct and indirect

benefits. Frankly, the Regina Chamber of Commerce does not know if an accurate check can ever be made of the indirect, regional, and national benefits of this project or of such projects as the St. Lawrence Waterway, and Trans Canada Highways.

The Chamber accepts the conclusion, again of the Honourable C. D. Howe, quoting from the same address when he says:

"It is because of the value of irrigation to the state that governments are prepared to contribute largely to the cost of irrigation development."

The Regina Chamber of Commerce believes that the South Saskatchewan River Development project has such value that it does merit the support of all Canadians, and that it should be proceeded with now.

Respectfully submitted by The Regina
Chamber of Commerce
September 10th, 1952

G. F. CONNELL,
President.

A. AITKEN,
Secretary.

Brief of the Council of the City of Moose Jaw for Presentation to the Commission Appointed in Respect of the Proposed Construction of a Dam on the South Saskatchewan River

MAYOR L. H. LEWRY

Moose Jaw's Support of Plan has been consistent

From the moment when the project was first proposed, every Citizen of Moose Jaw has given support and approval to the plan for the construction of a dam on the South Saskatchewan River, in the vicinity of Outlook.

City's Economic Life dependent upon thriving Agricultural Community.

The reason for such support is readily understandable; Moose Jaw is primarily an agricultural centre; our economic welfare is linked directly with that of the surrounding farming community, embracing, as a major part, the lands between the city and Outlook which could be brought under irrigation if the project is carried out.

Moose Jaw's Situation compared with Lethbridge

Moose Jaw's economic life may be compared with that of Lethbridge. Both cities depend almost wholly upon agricultural production within their respective

trading areas. Irrigation in the Lethbridge area has assured a balanced production with reasonably steady employment and income. At Moose Jaw we have learned that one crop failure in our vicinity can and does have an immediate adverse effect upon the prosperity of our citizens; a series of successive crop failures brings unemployment, and business failures; tax defaults occur, and the whole civic plant deteriorates through lack of funds for maintenance.

Drought Years Reviewed

The drought years, 1930-40, brought disaster to the city. We sold our electric light and power plant in 1930 for \$2,875,500 and used the money mainly to provide relief for our needy citizens and to pay the instalments of principal and interest maturing on our debenture debt.

In 1937, we were forced, through lack of funds, to default on our debenture debt, and were unable to resume payments until 1946.

The attached schedule gives particulars of the cost of direct relief, and the numbers of our citizens who were obliged to seek aid during the drought years.

This schedule indicates only part of the financial cost; tax arrears accumulated, on which substantial discounts ultimately had to be granted, and costs on deferred maintenance were greatly increased by reason of the delay in carrying out such works.

The schedule also indicates that, while relief was not a material problem prior to 1930, many of those citizens who were out of employment for 10 years or more, have not since been able to re-establish themselves, and still require aid; thus we and they are still paying the toll of the succession of crop failures in our community.

We also provided aid to many rural families

Our relief problem was aggravated also by the large numbers of rural people who failed on their farms, and moved to the city. A check made during the peak relief years showed that one-third of those for whom we were providing, came to the city from rural areas subsequently to 1928.

The dread toll of drought can be partially averted

The point we wish to stress here is that the misfortunes which befell the city and its citizens during the drought years would have been considerably lessened had the large area to our north, between the city and Outlook been under irrigation. In recalling the effects of the drought on Moose Jaw and its citizens, we should not forget the appalling suffering of the families

trying to eke out an existence on the farms. Our aim now should be to avert, as far as humanly possible, a repetition of that disaster.

The Dam will assure an adequate supply of water for Municipal Purposes

One other reason we in Moose Jaw support this project, is that it will assure this city of an adequate and constant water supply.

Our main water supply is at present derived from a natural reservoir at Caron, which has to be replenished by water pumped from the river near Riverhurst and transmitted by gravity flow down a 70 mile long earthen canal to the reservoir. At low periods the sands shift in the river, frequently completely blocking the intake. A dam would relieve any worry over the availability of river water. Furthermore, Moose Jaw intends (subject to being able to arrange necessary financing), to join Regina in the operation of the water production system that city is now developing on Buffalo Lake.

The Dominion Government has committed itself to maintain an adequate supply of water in Buffalo Lake to meet the requirements of the two cities, and of any other municipality which might desire to obtain its supplies from that source.

In periods of low run-off, the Dominion will find it necessary to bring water from the South Saskatchewan River to Buffalo Lake. A dam would seem to be an essential to the carrying out of the Dominion's undertaking, not only from the point of view of insuring that there will be adequate water available, but the cost of pumping from the river at its normal levels would be prohibitive. With a dam, little, if any pumping, would be necessary. Water levels in the river behind the dam would be raised sufficiently to permit the release of sufficient quantities by gravity flow to Buffalo Pound Lake.

Hydroelectric Power development an indirect asset to the City

The construction of the dam will make possible the production of an immense quantity of cheap hydroelectric power. This will improve the economic well-being of the entire province, and even those centres such as Moose Jaw, which already has a relatively cheap supply of power, will indirectly benefit therefrom.

We appreciate that the Commission will have many briefs presented to it in reference to this project, and have therefore limited our presentation to a short

statement of the main reasons why every citizen in Moose Jaw hopes to see this project undertaken in the very near future.

Respectfully submitted in behalf of the Moose Jaw City Council.

By

LOUIS H. LEWRY
Mayor and Commissioner

J. S. MARQUIS
City Commissioner.

September 10, 1952.

EXPENDITURES MADE BY CITY OF MOOSE JAW FOR
UNEMPLOYMENT RELIEF—1927-1947.

Year	Direct Relief City's share	Number on Relief	Total Population Census	Percentage of Popula- tion on Relief
	\$ cts.			
1927.....	2,959 86	No Record	19,039	No Record
1928.....	4,139 93	No Record	19,039	No Record
1929.....	3,172 77	No Record	19,039	No Record
1930.....	9,176 08	No Record	19,039	No Record
1931.....	37,691 33	2,400	21,299	11.26%
1932.....	78,135 79	3,352	21,299	15.73
1933.....	166,460 19	4,428	21,299	20.79
1934.....	202,099 83	4,644	21,299	21.8
1935.....	193,015 45	4,512	21,299	21.18
1936.....	135,568 76	4,000	19,872	20.12
1937.....	144,124 42	4,296	19,872	21.62
1938.....	166,941 51	4,497	19,872	22.63
1939.....	161,774 04	4,253	19,872	21.40
1940.....	137,825 86	3,460	20,496	16.88
1941.....	103,076 42	1,977	20,496	9.64
1942.....	61,125 82	689	20,496	3.36
1943.....	50,103 66	339	20,496	1.65
1944.....	44,395 84	256	20,496	1.24
1945.....	35,531 44	238	20,496	1.16
1946.....	37,390 55	280	23,039	1.21
1947.....	41,689 32	300	23,039	1.30
Total....	1,816,398 87			

NOTE: The above figures are the actual outlays made by the City from its own resources, and do not include contributions made by Senior Governments.

Note further: Prior to 1930. Unemployment relief presented no financial problem—Municipal costs rarely exceeded \$3,000.00 annually.

Average cost for the 10 peak years (1932 to 1941 incl.) was \$148,902.22; average number on relief for the same period was 3,942.

Brief of the Moose Jaw Chamber of Commerce
to the Royal Commission on the South Saskat-
chewan River Project

MR. R. G. McCARTNEY

Mr. Chairman and Gentlemen:

Ever since the first settlers came to Moose Jaw, the lack of water has been our foremost problem.

From the proceedings of the initial meeting, held October 1st, 1888, as recorded in the original minute book of the Moose Jaw Board of Trade, as it was then known, we note that the very first problems to be dealt with by this new organization concerned water.

The first motion on the books indicates that the meeting deemed it advisable and necessary to find water within 15 miles of Moose Jaw. The second motion instructed that a Committee be set up to have a reservoir built to impound water and to secure funds from the territorial grant or elsewhere for the building of this reservoir.

We mention this early history to show that water is not a new problem to us. Ever since that first meeting in 1888 and down through the years, the minutes of the Moose Jaw Chamber of Commerce are interspersed with motions concerning water in relation to domestic supplies and agriculture.

In 1947, the farm lands in our area were so parched, that they were burning up. The Moose Jaw Chamber of Commerce was possibly the first group on the western prairies to endeavour to bring relief to the parched soil by creating rain. We did this by means of seeding clouds with dry ice. While some rain did fall, within a limited area, it was, at best only a feeble and partial solution to a massive problem. All through the history of the Chamber we see committees working on problems dealing with water and irrigation. These committees, throughout the years have all worked towards a permanent solution to the problem. As a result of their work, the Saskatchewan Rivers Development Association was organized in 1946 in co-operation with other groups. We have been and remain supporters of this Association and its objectives, the most important of which is the South Saskatchewan River Project. We know from bitter experience the need for irrigation so that our farming economy may be stabilized, which in turn will stabilize the economics of the urban centres.

Agriculture is still Canada's most important industry, on the base of which our whole national economy rests. We see this base now being endangered by an unsocial trend in farming i.e. the trend to the larger farm unit which results in decreasing population. The larger farm unit has worked hardships on the young

people of today, as it is practically impossible for a young couple starting out in life to take up dry-land farming. The economic unit is now so large, a section of land or more, that the investment in land alone puts grain farming out of the reach of the average young Canadian. In addition to this great amount of land, a further overwhelming burden of investment in machinery is required. The young generation of today does not have, in most instances the resources needed to start dry-land farming. As a result of this we see our young people seeking opportunities in other lines of endeavour and in other fields. They are leaving the land and moving to the cities. We firmly believe that irrigation with its smaller farms would definitely reverse this trend to a great extent.

Cities, such as Moose Jaw, are dependent upon prosperous farm communities. These communities, made up of individual farms, in turn are dependent upon the vagaries of rainfall. If this rain does not come in sufficient quantities, and at the right time of the year, then farming cannot be successful. The stores and offices, the industries and professions of a city, in the main, exist for the purpose of serving the farming community, and to process the products of the farmers' fields. If there are no crops then not only do the farmers suffer, but all in the urban centres as well. This was only too disastrously shown in those drought years of the 'thirties'.

Moose Jaw is an industrial city, surrounded by a farming area. When we examine the industries located in our city we find that a great many of them depend upon the farmers for their raw materials. We have packing plants, dairies and creameries, flour mills, et cetera, all drawing from the farms. Currently we see our packing plants laying off employees and curtailing operations. We feel that one of the reasons for this can be found in the larger farm unit. The farmer is not raising the cattle and hogs as he did in yesteryear, but is devoting his operations solely to grain production. Our stockyards, which are the most important west of Winnipeg, are showing a decline each successive year. Cattle are not being raised on the farms. Our dairies find it more and more difficult to secure raw milk. Mixed farming is becoming a thing of the past. Part of the reason for the decline in dairy herds is attributable to the feed situation. Feed has not always been available when needed, and many a farmer has found it necessary to import fodder at an uneconomic cost. We believe that if a farmer had an assured feed supply such as would be available from irrigation, instead of curtailing his dairy operations he could expand and increase his herds. With greater numbers of milch cows

he could then modernize his dairy farm, put in mechanical milking equipment, and thus, through modern facilities make dairy farming more attractive. Much of the milk consumed in Moose Jaw, and we daresay in the other large urban centres in Saskatchewan, during a large part of the year, is made from powder brought in from as far away as New Zealand.

We admit that the points we have introduced today are purely local problems, problems that affect a city in an agricultural area. We have confined our remarks purposely to this viewpoint because we feel, gentlemen, that you will have read and heard a great deal of data pertaining to the Provincial and Dominion points of view.

We hope our contribution to this hearing will help the Commission in rendering its report to the Government of Canada. We sincerely and earnestly believe that the report should be in favour of the project because of the unlimited benefits that will accrue to all sections of Canada and its people.

Respectfully submitted this 10th day of September, 1952.

MOOSE JAW CHAMBER OF COMMERCE

R. G. McCARTNEY,
President.

G. O'SHAUGHNESSY,
Secretary.

**Submission of the Saskatchewan Board of Trade
to the Royal Commission Appointed to Conduct
an Enquiry into the Following Matter, Namely:**

WHETHER the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River project, (Central Saskatchewan development), would be commensurate with the cost thereof.

WHETHER the said project represents the most profitable and desirable use which can be made of the physical resources involved.

Dr. T. H. Hogg—Chairman.

Dr. John A. Widtsoe.

Mr. Geoffrey A. Gaherty.

Mr. B. T. Richardson—Secretary.

Mr. Chairman, gentlemen:—

The Saskatchewan Board of Trade, which is composed of some seventy Boards of Trade and Chambers of Commerce (of which the majority is in the smaller urban centres in the province), and having as one of its

chief objectives the promotion of the agricultural, civic, commercial and industrial welfare of the province, desires to place before you its endorsement of the South Saskatchewan River development project, and to present its reasons for believing that the project should be completed without further delay.

The members of the Boards and Chambers comprised in the Saskatchewan Board of Trade are engaged in business and commerce, industry, the professions and agriculture. They are vitally concerned with the development of a program that will give permanent stability to the economy of Saskatchewan. The Saskatchewan Board of Trade is convinced that the completion and operation of the South Saskatchewan River development project, in all its aspects, would be a tremendous factor in stabilizing that economy.

Under the present system of dry-land agriculture this economy is highly vulnerable to a number of factors. Where as much as nine-tenths of the population is dependent on one crop—wheat—the extreme variations in average yield from 2.5 to 25.1 bushels to the acre, the incidence of loss due to frost, wet harvest seasons, disease and insect pests, have created a condition of great instability. During the drought and depression years the income of Saskatchewan decreased 73 per cent and this could happen again. The dependence of a one-crop economy on outside markets and world prices, is well known and the recent suggestion that the bumper crop of 1952 may cause a lowering of both ceiling and floor prices under the International Wheat Agreement, when the Wheat Council meets next January, is the most recent manifestation of this factor.

The livestock industry too, is vulnerable when rainfall is not adequate to produce feed and pasture for the stock, of which there are close to 3,000,000 head in the province. The need for a dependable supply of feed and fodder in good and bad years is self-evident, and the development of the South Saskatchewan River Development project offers a means of meeting that need.

One of the results of this instability, which has been of great concern to the people of Saskatchewan, is the continuing loss of population. From 1931-41 the prairie provinces lost approximately 250,000 people, and a similar loss was experienced from 1941-1946. Since 1946 the population of Saskatchewan has continued to decline, while the populations of Manitoba and Alberta have increased. The loss of population has been particularly from the rural areas, as indicated by the fact that many of our towns have increased in size. The loss of rural population has created not only an economic problem, but a social problem as well. The main-

tenance of roads, telephone services, schools and the social aspects of community life is becoming more and more difficult.

In the area which will be directly affected by the South Saskatchewan River development project, the rural population is about three persons per square mile. Under irrigation, the population, on the other hand, could be comparable to that of southern Alberta, which is 29.7 persons per square mile in the northern irrigation district, and 60 persons per square mile in the Taber irrigation district. It has been predicted that the development of the project would more than double the number of farms in the immediate area and would increase the value of the crops produced from four million dollars to ten million dollars. We are convinced that this development will not only stabilize the immediate district concerned, but will have a stabilizing effect on the whole economy of the province, and indeed, strengthen the economy of the whole Dominion of Canada.

Saskatchewan needs, not only to maintain and increase her population, and to stabilize her agriculture, but also to develop secondary industry for which irrigation can provide the raw products. Meat packing establishments, sugar factories, canning plants and other food processing enterprises, creameries etc., would be made possible by the diversification of agriculture under irrigation.

While we have regarded the restoration and stabilization of the farm economy as the first consideration, the generation of hydro-electric power may have equal or even greater significance in the development of the province. The creation of a large bloc of electric power at a central point in this province would be a substantial factor in encouraging industrial development and in improving both urban and rural living conditions. Absence of some of the amenities of life no doubt have contributed to the exodus from the farm. Availability of electricity would do much to check this movement, especially when combined with other factors provided by irrigated farming. The forecast by the Saskatchewan Power Corporation that the power demands in the area which can be served from this plant will be able to absorb the output as soon as it is available, is indicative of the importance of this phase of the project.

Although we realize that it would be very difficult to accurately assess all the factors determining the economic value of the project, we respectfully suggest that the Commission take into consideration the possible cost of failure to develop irrigation to provide for the stability of Saskatchewan. We are aware that you have detailed records of the cost of the Prairie Farm

Assistance program in the province and in the immediate area of the project. Since 1939 the Prairie Farm Assistance has paid out more than 140 million dollars to farmers in the three prairie provinces. This drain on the finances of our Government will continue until the hazards of low rainfall and drought are overcome. We wish too, to remind the Commission of the tremendous cost to the government in transporting feed and fodder into Saskatchewan to sustain the livestock industry during the drought years. We feel that it is imperative to prevent a recurrence of the conditions of 1937 when relief expenditures were fully twice as great as all Municipal and Provincial revenues, exclusive of Federal subsidies.

An economic survey of the irrigation districts in Alberta, which was recently concluded by the Agricultural Economics Division of the Federal Government, points out that the investment required for the development of irrigation requires a capital expenditure which cannot be an immediate charge on the irrigated area. It showed too that investment by a private company, without other interests to develop, was a losing venture, but that the Canadian Pacific Railway and the Federal and Provincial Governments had financed irrigation and would be reimbursed through increased revenues directly attributable to greater production under irrigation over a period of years.

The prediction for the South Saskatchewan River development project is that when fully developed, the irrigation system could be expected to meet the cost of operation and maintenance and contribute to the capital cost of the distributing system. Indirect benefits of the project and subsidiary developments should justify the capital expenditure.

The Saskatchewan Board of Trade is not qualified to state that the project represents the most profitable and desirable use which can be made of the physical resources involved, or to offer an expert opinion on that question. However, it is aware that investigations have shown that the land and climatic conditions are as favourable for irrigation as those found in the irrigation districts of Southern Alberta. It has been stated also that the location of the proposed dam provides the most feasible and economic means of bringing water to the dry areas situated on both sides of the river; that a dam at the proposed site affords the most central location for the distribution of hydro-electric energy in the Province; that the storage provided by a high dam at the Coteau Creek site will afford a greater measure of flood control than would a similar project situated elsewhere; that the site of the proposed dam and reservoir provides the best location from which to

secure an adequate water supply for the cities of Moose Jaw, Regina and intermediate points; that the site of the proposed dam provides the best location for augmenting the low water flow in the Qu'Appelle and Assiniboine Rivers and for maintaining the water levels in the chain of lakes situated in the Qu'Appelle Valley and Long Lake; that from the available water supply a greater number of people, presently situated in the drought area, can be served by this project than would be the case if the project were situated elsewhere; that there is no similar low rainfall area, in all the prairie region, where so much good land can be irrigated from an available water supply in such close proximity thereto; and that because of its favourable location, and for other reasons, the project lends itself particularly to the development and stabilization of the livestock industry.

The Saskatchewan Board of Trade, in view of the experience in Alberta, is of the opinion that the development of the South Saskatchewan River Development project should be undertaken as a Government project without further delay.

Respectfully submitted, September 10, 1952.

THE SASKATCHEWAN BOARD OF TRADE

HARRY BOYCE,

President.

HERBERT A. PURDY,

Executive Secretary.

Submission by Dr. F. Hedley Auld

Regina, Saskatchewan.

September 10, 1952.

Dr. T. H. Hogg,

Chairman,

Royal Commission on the South Saskatchewan River Project,

406 Elgin Building,

OTTAWA, Ontario.

Dear Sir:

I have the honour to present some facts and opinions concerning the Saskatchewan River Development Project. I wish to say something about the agricultural economy of Saskatchewan, the severe drought in the "thirties", the serious problems which then arose, and to indicate what the Saskatchewan River Development

Project would mean in stabilizing the Agriculture of Saskatchewan and in helping to solve relief problems when another drought period occurs as it undoubtedly will.

Yours faithfully,

F. HEDLEY AULD.

**SOUTH SASKATCHEWAN RIVER DEVELOPMENT IN RELATION
TO SOME OF SASKATCHEWAN'S AGRICULTURE PROBLEMS**

It is characteristic of Saskatchewan's unstable economy and variable climate that this special study in which you are engaged concerning the Saskatchewan River Development for irrigation and power should be made at a time when agricultural production and farm income are at an alltime high level. Current conditions, however, contrast sharply with those in the "30's" which caused the establishment of Prairie Farm Rehabilitation Administration and demonstrated the need to develop the South Saskatchewan River as a source of water for irrigation farming to counteract the deficiencies of our sub-humid climate.

**TABLE 1.—SASKATCHEWAN FARM INCOME BY CALENDER
YEARS (THOUSAND DOLLARS)**

Year	Principal Field Crops	Total Livestock Products	Miscellaneous, including Federal Supplementary Payments	Total
	\$		\$	\$
1926.....	257,530	29,871	3,741	291,142
1927.....	238,156	29,786	3,533	271,475
1928.....	285,722	31,738	4,046	321,506
1929.....	207,075	34,494	3,564	245,133
1930.....	94,096	25,870	2,432	122,398
1931.....	48,752	19,847	2,009	70,608
1932.....	62,415	13,684	1,535	77,634
1933.....	59,131	14,565	2,915	76,611
1934.....	70,089	20,653	2,630	93,372
1935.....	79,095	25,920	3,128	108,143
1936.....	92,302	30,493	3,045	125,840
1937.....	40,053	41,231	2,878	84,162
1938.....	67,557	22,610	2,974	93,141
1939.....	127,342	27,242	5,377	159,961
1940.....	108,782	38,226	10,922	157,930
1941.....	100,526	56,846	22,810	180,182
1942.....	110,268	79,867	38,688	228,823
1943.....	208,551	111,523	24,865	344,939
1944.....	388,491	144,978	21,820	555,289
1945.....	272,452	127,836	12,231	412,519
1946.....	267,674	111,270	21,106	400,050
1947.....	315,831	102,268	20,229	438,328
1948.....	372,555	146,477	31,660	550,692
1949.....	422,157	128,986	29,129	580,272
1950.....	267,142	130,086	19,287	416,515
1951.....	461,687	151,214	19,272	632,173

To show the great variation in annual agricultural income in Saskatchewan I submit the following Table, beginning with 1926. These figures compiled from the records of the Dominion Bureau of Statistics are arranged to show the revenues from the principal sources of agricultural income, "field crops", "livestock", and "livestock products" and "miscellaneous" including supplementary payments, such as Prairie Farm Assistance, provided by the Canadian Government beginning with the year 1939.

Table 1 shows clearly the well known importance of cereal grains as a source of farm income in Saskatchewan and needs no emphasis. It also reveals the great variation in volume of income from year to year and period to period; instability of income is implicit and obvious in the foregoing statement.

Only once in the years reviewed in Table 1 has income from livestock in Saskatchewan exceeded that from field crops. That occurred in 1937 when feed for farm animals was so scarce that a forced liquidation of cattle became inevitable. Those years, for many farmers, marked the end of their efforts to raise cattle until greater assurance could be had that fodder and grain could be grown to avoid a similar debacle. I shall later in this paper deal with this in more detail.

**TABLE 2.—PERCENTAGE DISTRIBUTION OF FARM
CASH INCOME**

	1926-29	1935-39	1943-45	1948	1951
—	%	%	%	%	%
<i>Manitoba—</i>					
Grains and other					
field crops.....	65.65	56.22	50.88	58.46	61.53
Livestock and live-					
stock products...	31.91	39.77	46.21	38.75	35.86
Other.....	2.44	4.01	2.91	2.79	2.61
	100	100	100	100	100
<i>Saskatchewan—</i>					
Grain etc.....	87.68	72.15	68.32	69.95	74.02
Livestock.....	11.15	25.91	30.00	28.08	24.13
Other.....	1.17	1.94	1.68	1.97	1.85
	100	100	100	100	100
<i>Alberta—</i>					
Grain etc.....	73.78	61.25	46.09	53.06	51.86
Livestock.....	24.69	36.53	51.54	44.59	45.86
Other.....	1.53	2.22	2.37	2.35	2.28
	100	100	100	100	100

At this point I wish to present another table to show the percentage variation in the principal sources of farm income in Saskatchewan by periods with comparable data for Manitoba and Alberta where the products of animal industry have apparently been regularly contributing a larger proportion of farm income than in this province.

Table 2 emphasizes even more clearly than Table 1 the tendency of Saskatchewan farmers to rely on grain as their principal source of income. It shows also that in all three provinces the income from livestock was highest in proportion to field crops in the war years 1943-45. At that time the numbers of cattle, sheep and hogs on Saskatchewan farms were at the highest level in our history. However, after that date, although livestock prices moved to still higher levels, there was heavier selling by stock men who wanted to cash in at unheard of values in anticipation of a deflation similar to that which followed the first World War. Other reasons for liquidating livestock at the close of the war were higher grain prices, a higher level of income and the newly experienced incidence of income taxes.

Community Pastures

Community pasture development under the Prairie Farm Rehabilitation Administration, which has a parallel in the pastures operated on a similar pattern by the Saskatchewan Government, is already an important factor in the Saskatchewan River development area. I show you a map on which are outlined the seven community pastures situated within the eighteen municipalities which have come to be considered the Saskatchewan River development area. The number of cattle and horses admitted to these pastures annually for grazing are shown in Table 3. The 1942 figures relate to animals in pastures in September while the 1952 figures cover pasture patronage to the end of August.

Some of the land included in these community pastures had been previously homesteaded and abandoned. Other portions which had been withheld from settlement, had been formed into Forest Reserves which were open for grazing of livestock owned by members of organized Forest Grazing Associations. Being now well fenced and provided with adequate watering places, they serve a useful purpose in supporting livestock production on neighboring grain farms. They should become even more useful in association with the proposed irrigation development.

TABLE 3. *Aggregate numbers of Cattle and Horses accepted in seven Community Pastures in R.M.'s. 223/4, 255, 257, 284, 314, 315, and 375 during the years 1942 to 1952 inclusive: (Figures furnished by P.F.R.A.)*

<i>Year</i>	<i>Cattle</i>	<i>Horses</i>
1942	4,526	1,345
1943	5,012	1,700
1944	5,827	1,117
1945	6,731	1,110
1946	6,681	587
1947	6,395	478
1948	7,487	392
1949	7,444	522
1950	7,482	417
1951	8,197	350
1952	8,536	262

Prairie Farm Assistance

The map which I now present to you has been prepared to show the frequency of crop failure payments to farmers under the Prairie Farm Assistance Act in Saskatchewan during the years 1939 to 1950 inclusive. While the map shows the number of times payments have been made in Saskatchewan townships, it is not to be inferred that all farmers in such townships were eligible to receive an award under the Act in each year in which payments were made. It is possible for only a part of a township to be eligible. To show the entire picture it would be necessary to give the number of eligible farmers, the number who received awards and the amount of the awards. Nevertheless, the number of years in which awards are paid in a township is in itself an index of climate and productivity in so far as wheat is concerned, and a useful measure of crop production. No awards were made under the Act in the area in the years 1942, 1944 and 1951; and it is expected that none will be necessary in 1952. The figures in the several townships, therefore, indicate the number of times in thirteen years payments have been made under the Prairie Farm Assistance Act in these townships.

Payments to provide food, fuel and clothing for farmers, fodder for their animals and seed and other supplies to enable them to continue farming operations were necessary at various times prior to 1939 when P.F.A. Act was passed by the Parliament of Canada. The brief submitted to you by the Government of Saskatchewan states more clearly the extent to which these various forms of assistance were provided, and the matter is reviewed in detail in the booklet, "Rural Relief in Western Canada", by Dr. E. W. Stapleford.

*Prairie Farm Assistance and Relief Payments in
Saskatchewan River Development Area*

To focus attention on the problem of farm subsidies and possible alternatives it is necessary to leave the larger area of drought incidence and review the situation in those municipalities considered to be within the Saskatchewan River Development Area. Ten of these have lands capable of being irrigated through the completion of the Project. Eight others are so near the Development Area and so likely to derive substantial benefits from it that it has been thought proper to set forth also their record with respect to P.F.A. payments and their earlier participation in relief measures. These data are shown in Table 4.

TABLE 4. — *Summary of Relief Assistance and Prairie Farm Assistance Payments in certain Rural Municipalities.*

(a) Municipalities with irrigable lands.

R.M. Nos.	Relief	P.F.A.A.	Total
253	\$ 545,282.49	\$ 595,125.90	\$ 1,140,408.39
254	900,800.46	864,724.55	1,765,525.01
283	645,915.75	845,062.04	1,490,977.79
284	768,207.50	853,180.93	1,621,388.43
285	835,051.56	515,146.17	1,350,197.73
315	408,635.63	387,244.30	795,879.93
343	483,525.54	615,232.73	1,098,758.27
344	438,149.39	415,379.76	853,529.15
345	549,000.02	613,430.44	1,162,430.46
346	482,200.86	510,175.37	992,376.23
	<hr/> \$6,056,769.20	<hr/> \$ 6,214,702.19	<hr/> \$12,271,471.39

(b) Contiguous Municipalities without Irrigable Land.

223	\$ 569,783.88	\$ 478,267.34	\$ 1,048,051.22
224	745,093.31	724,067.24	1,469,160.55
225	521,613.11	494,427.48	1,016,040.59
255	607,673.62	487,597.10	1,095,270.72
313	336,295.31	392,041.71	728,337.12
314	280,041.88	291,081.38	571,123.26
375	295,989.96	538,836.62	834,826.58
376	341,344.44	564,394.30	905,738.74
	<hr/> \$3,697,835.51	<hr/> \$ 3,970,713.27	<hr/> \$ 7,668,548.78
Grand Total	\$9,754,604.71	\$10,185,415.46	\$19,940,020.17

While these figures related to a few municipalities are very impressive, they are dwarfed by comparison with the huge aggregate of relief expenditures made in all of Saskatchewan prior to 1939, given in the Saskatchewan Government's Brief as \$186,500,000 and a total of payments made by P.F.A. Administration since 1939 amounting to \$102,007,324.

Problems of Fodder Supply

During the "thirties" the scarcity of fodder occasioned greater difficulties in meeting the deficiency than the supplying of grain for feed and seed, although they were somewhat related problems. It was necessary to locate the fodder, frequently at great distances from the place of need. It was often necessary to bale and ship straw from stacks covered with snow—operations which were slow and difficult in sub-zero weather. The difficulties inherent in operations of this nature were anything but encouraging to owners of livestock. In the winter of 1937-38 shipments of fodder to the drought area in Saskatchewan amounted to 413,276 tons, the over-all delivered cost of which was \$10,692,103.00. The cost of fodder provided in Saskatchewan during the six previous years was \$19,794,702.00 exclusive of transportation which at a reduced rate, generously given by the railways, amounted to \$4,498,173.00. Thus there was a total outlay of \$35,124,834.00 for fodder and transportation during a seven year period. This, of course, is a part of the total relief assistance mentioned earlier in this paper. All available fodder between Montreal and Vancouver was bought and additional supplies were imported from Minnesota and North Dakota. In the light of that experience, would the use of the Saskatchewan River for irrigation be of material assistance in meeting the problems of fodder supply should another period of extreme drought occur? To this there would appear to be only one possible answer.

CATTLE PRODUCTION IN SASKATCHEWAN

Since farmers in most countries have found the raising of some kind of livestock to be indispensable to permanent agriculture, it may be useful to examine the situation in Saskatchewan more closely and consider whether the development of the Saskatchewan River Project contains a hope of improvement in this regard. Among the influences retarding the production of meat animals in central Saskatchewan, some are of particular importance. They are the scarcity of permanent water supplies on many farms, limited grazing and the uncertainty of fodder supplies. That will, I think, be confirmed by the following comparison of cattle production in the vicinity of the Saskatchewan River Development with another group of Saskatchewan municipalities about two hundred miles farther East. These facts are set out in Table 5: the areas are indicated on the P.F.A.A. map.

TABLE 5: *Cattle Numbers in Census Years in Two Groups of Municipalities.*

(a) South Saskatchewan River Project Area.

R.M. No.	1931	1936	1941	1946	1951
253	2,108	2,393	2,212	2,247	2,348
254	3,307	3,441	2,855	2,997	2,545
283	3,867	3,377	2,702	3,201	2,613
284	3,934	3,264	2,940	3,010	2,278
285	3,232	3,684	2,671	2,669	2,259
314	3,227	3,928	2,676	3,351	3,237
315	4,240	4,667	3,402	4,150	3,512
316	3,010	3,694	2,828	3,347	2,702
343	3,734	4,388	3,480	3,535	2,843
344	5,244	5,838	4,747	4,522	4,237
345	5,576	6,249	4,788	5,251	4,045
346	3,901	4,303	3,249	2,768	2,407
	45,380	49,226	38,550	41,048	35,026

(b) East Central Saskatchewan Area.

R.M. No.	1931	1936	1941	1946	1951
152	5,796	6,531	5,869	7,515	6,534
181	6,616	7,288	6,612	7,578	6,428
183	7,199	8,980	8,529	10,179	8,090
211	9,689	10,855	9,381	11,250	9,418
213	6,196	8,057	6,313	7,089	6,009
241	5,298	7,575	6,966	8,015	6,259
243	6,468	8,110	6,553	8,507	6,105
271	5,788	6,875	5,683	5,668	4,773
273	5,857	7,051	6,738	7,280	5,538
301	3,800	4,964	4,236	4,472	3,705
303	4,696	5,779	4,924	4,875	3,513
	67,403	82,065	71,804	82,428	66,372

The foregoing figures show two cyclical peaks in cattle numbers in the Census years 1936 and 1946; actually these occurred in 1934-35 and in 1945. These figures also show the optimism of farmers, when farm income was falling in the "thirties", in increasing their holdings of cattle despite the uncertainty of feeding them. I wish, however, to direct your attention to the trends in these two districts and try to find reasons for the difference. A greater degree of stability in cattle production is shown in the Eastern district with numbers in 1951 almost equal to those recorded for 1931. Cattle numbers in 1931 and 1951 show there was a difference of only 1,031 or 1.5 per cent, in the Eastern group as compared with the Saskatchewan River group where there were 10,354 head less than in 1931 a percentage drop of 22.8. In Canada numbers of cattle declined after the war; but declines were greatest where cattle raising seemed least attractive. The Eastern Saskatchewan district under consideration, which continued cattle production at a high level, is also an area of crop stability as shown by the record of the Prairie Farm Assistance Administration. It is, in fact, park belt country where water supplies are more adequate and fodder production is less precarious than in the area of the proposed Sas-

katchewan River Development. This comparison of production trends may be amplified and confirmed by a study of the census figures of cattle in Census Districts 5 and 9 in Eastern Saskatchewan in comparison with similar figures for District 11 in Central Saskatchewan. District 5 had more than twice as many cattle in 1951 as there were in District 11 and District 9 had 72 per cent more than District 11. District 5 had 12 per cent more cattle in 1951 than in 1931. In 1951, District 9 had 3 per cent less than in 1931 and District 11 had 16 per cent less than in 1931.

An examination of the situation in the central area of Saskatchewan leads me to the conclusion that the severe shrinkage in numbers which there occurred was due to the greater difficulties of keeping cattle and that what is most needed to enlarge cattle production there and elsewhere in Saskatchewan is to overcome the two principal handicaps of cattle raisers—water and fodder scarcity—and the greatest assistance would be the development of the Saskatchewan River irrigation possibilities.

Possible Local, Provincial and National Benefits

I do not apologize for this lengthy review of difficulties inherent in Saskatchewan agriculture. They are Saskatchewan's major problem. But for it, the inquiry which you are now conducting would not have been necessary. The Saskatchewan River Development came to life through the efforts of the Prairie Farm Rehabilitation Administration to utilize every available resource of water in its major objective of stabilizing prairie agriculture against the ravages of recurring drought. And now we are trying to determine whether the agricultural economy of Saskatchewan would be significantly benefited by the Saskatchewan River Development; whether that development would enable a substantially greater number of our farm-reared young people to remain in Saskatchewan and whether the project would be important to Canada as a whole.

As to the first of these, it seems reasonable to assume that the farmers in the ten municipalities in which irrigation is feasible should be completely freed from fears of dependence upon the State in periods of drought; and the sums now being paid to them under P.F.A.A. should thereby be largely saved. An important point, certainly, when water can be applied to irrigable acres, they should not be eligible to participate in compensation provided for crop failure through drought. Nor should it be necessary for dry-land farmers, close to feed supplies, to reduce livestock numbers when their own crops fall below the average yield. In a similar manner, the benefits of irrigation

production should spread to other areas not contiguous to the River Development. The finishing of livestock for market, so important elsewhere, is a definite possibility which need not be confined to the irrigated area, as roughage from irrigated farms could find a market miles distant from the place of production. Dairymen also would find this source of feed a great convenience as compared with present sources of fodder supply. And the distribution of potatoes and other vegetable crops for human consumption from irrigated farms in central Saskatchewan could be much more easily accomplished than in past years when importation on a large scale was necessary. In 1937-38, no less than 771 carloads of potatoes were supplied to the drought area as a relief measure. Under normal conditions the surplus potatoes grown in the irrigated district should be saleable in nearby urban centres in competition with supplies from more distant points. The smaller water development projects of the P.F.R.A., such as dugouts, dammed ravines to catch the run-off from winter precipitation and the irrigation schemes in the Cypress Hills and Wood Mountain drainage areas are useful and important to a degree; but they need to be supplemented by the Saskatchewan River Development in order to enable the Prairie Farm Rehabilitation to reach its fullest degree of success.

In regard to the second point, I am sure we are agreed that everything possible should be done to increase the opportunities for farm-raised young men to establish themselves in agriculture in their native province. That seems to be impossible without the development of irrigation on a substantial scale such as the Saskatchewan River would permit. In 1939 there were in other Canadian Provinces, 59,909 persons who were born in Saskatchewan. Ten years later, the number of Saskatchewan born in other parts of Canada was 135,927. It is not known how many others found locations elsewhere or how many immigrants to Saskatchewan moved out of the Province. It is not suggested that there would have been no losses of young people if more farms had been available. Nor is it expected that emigration from this Province would cease with the completion of the Saskatchewan River Project. But a loss of nearly 200,000 people a quarter of a century after a huge influx of settlement into a new region constitutes a population movement of great significance. On the basis of Alberta's experience, it has been estimated in the Saskatchewan Government Brief that the River Development would permit the establishment of 4,000 additional farm families. That would be important in itself; but it would not solve

the problem of population surplus to present opportunities in Saskatchewan; it is, nevertheless, to be welcomed.

The importance of irrigation in the stabilizing of agricultural communities is shown in the following statement taken from "The Economy of Montana", prepared by the Bureau of Business and Economic Research, School of Business Administration of the Montana State University and published in December, 1951. "The one-fifth of Montana's cropland which is irrigated, accounted in 1949 for 35.7 per cent of the total value of crop production. Over 50 per cent of all irrigated land is devoted to the production of hay—although irrigation projects have met with varying degrees of success in Montana, proper utilization of irrigated lands can help achieve a more stabilized agriculture. Irrigation can provide opportunities for farmers and ranchers on marginal dryland units and can help stabilize farm income by eliminating some of the hazards of non-irrigated farming and make possible a diversification of crops. Irrigation programs also offer opportunities for larger numbers of people within an area and aid in promoting community stability. In the thirties, most irrigated counties in Montana gained in population while many non-irrigated agricultural counties suffered sharp declines".

In relation to the Canadian economy, the development of the Saskatchewan River Project at an early date seems to be highly desirable in the national interest. At this time, Sir Wilfrid Laurier's prediction that this is Canada's century seems likely to be verified. With an established and expanding industrial development in Canada we are almost daily discovering new fields of gas and oil; and our new-found wealth in iron ore and other important mineral resources indicates a further enlargement of our economy and the possibility of maintaining a larger population. We have, therefore, an encouraging prospect of an expanding "home market" capable of absorbing more, if not all, of our production of meat and other animal products before many decades have passed into history. It is believed by some American economists who are concerned with long-range production policies that by 1975 Canada will no longer have meat surpluses to export to the United States. Current demand for beef is such that cattle prices are far higher in relation to hogs than has been customary in past years and they show small indication of returning to that former relationship which was that one hundred weight of "good" quality steer was equal in value to 75 pounds of hog on the hoof at Toronto. The large increase in population on Pacific states of the U. S. and the growth of industry and population in British

Columbia combine to make cattle rearing and animal production in the Great Plains area less dependent on Eastern and export markets.

In connection with beef production and as a further commentary on the importance of water development, I wish to submit the following information concerning the carrying capacity of an irrigated pasture of 15 acres in the Montana Agricultural Experiment Station at Bozeman, Montana. This information was given to Mr. E. E. Brockelbank, M. Sc., Director, Animal Industry Branch of the Saskatchewan Department of Agriculture, by Professor Fred. S. Willson, Professor and Head of Animal Industry and Range Management:

1. Size of pasture—15 acres.
2. The mixture was a modified Huntly mixture, which is highly recommended. It consists of brome grass, orchard grass and blue grass with alsike clover, dutch white clover and one other clover.
3. Record of production for summer 1950.
 - (a) 40 steers for 136 days—steers were being grain fed on self-feeder as well.
 - (b) 200 lambs for one week to eat surplus growth.
 - (c) cut $\frac{1}{2}$ ton hay per acre.
 - (d) 38 cows pastured for one week after October 1 to clean it off.

This pasture had no fertilizer except farm manure at the rate of about 15 tons per acre. It was watered each three weeks after July 1. After subtracting grain feed costs on the steers, it netted \$162.00 per acre with other feed for lambs and cows as well as the hay, free.

These figures suggest income possibilities from irrigation farming greater than have been estimated previously. But conditions of today are different, and the experiences of irrigation in Alberta some decades ago are unreliable as an indication of expected revenues from irrigation farming.

From the standpoint of Canada as a whole, there should be general agreement that the Saskatchewan River Development has merit. Greater population in Canada would be good for industry, transportation services and national defence and the Federal Treasury. For farmers, the home market is the best market; and more people in Canada would enlarge the possibilities for agriculture as well as industry. But more especially should we think of the benefits to the residents of the Saskatchewan River valley whose confidence will be increased as they see provision made to use the great volume of water, hitherto wasted, to water hundreds of thousands of acres of land and ensure that the labour of the farmer will not be unrewarded.

I understand that an important part of your task is to determine the economic soundness of the proposed Saskatchewan River Development. Frankly, I cannot believe that the problem is one of economics alone. And I think the best opinion as to the benefits of the scheme may prove to be an under-estimation. Palliser guessed that this prairie region was quite unsuited to agriculture. Although partly right, time has proved how wrong he was. Some one guessed that the Canadian Pacific Railway would not earn enough to buy grease to lubricate the axles of its rolling stock. Another bad guess! When a French king ceded Canada to England, he spoke slightly of it as "a few arpents of snow". With greater knowledge of our country I hope our faith in this great central part of Canada is such that will not sell our country "short" by missing or even delaying needlessly this development opportunity to correct as far as possible the chief deficiency in Saskatchewan agriculture. This is the football season. Players are taking risks; but all of them are trying to avoid a fumble which might cost a touchdown. The people of Saskatchewan will await your report and recommendations with keen interest and high expectations.

Regina, Sask.

F. HEDLEY AULD.

September 10, 1952.

Submission by Dr. George Spence

3150 Rae Street,
Regina, Saskatchewan,
August 28, 1952.

Mr. B. T. Richardson, Secretary,
Royal Commission on the South Saskatchewan River
Development, Ottawa, Canada.

Dear Mr. Richardson:

I attach herewith statement to the Royal Commission on the proposed South Saskatchewan River development.

It is submitted to amplify my previous memorandum of March 20, 1952, addressed to the three Commissioners and yourself.

I desire to say that my interest in the proposed project is solely of a public nature. I represent no one in particular.

Any claim that I might have to be heard is based on twenty years in the public life of Saskatchewan, together with my experience, first as liaison officer and later as director of the Prairie Farm Rehabilitation Administration during the period when much of that organization's water development and land utilization work was being initiated. I may say, too, that the views expressed in the statement are also based on forty years' practical farming experience in the drought area.

My only purpose in submitting these statements is a desire to make such a contribution as I can to the rehabilitation of agriculture in the prairie region.

I am in hope that I can present this statement in person to the Commission, either at its Regina or Saskatoon hearings. In case circumstances beyond my control prevent me from doing so, I am asking Mr. Harold Pope, Q.C., counsel for the Saskatchewan Government, to present the statement on my behalf and also to file, with the Commission, the pertinent documents.

Yours faithfully,

GEORGE SPENCE.

GS/MR

Interpretation of Reference

It is noted that the terms of reference to the Royal Commission on the proposed South Saskatchewan River development are broad and comprehensive in their scope and call for a complete analysis and study of the physical, economic and social factors involved.

The Commission is particularly directed to examine whether the economic and social returns to the Canadian people in the investment would justify the costs of the project and also as to whether or not the proposed project represents the most profitable and desirable use which can be made of the physical resources involved.

It will be noted that the words "social returns" are used in conjunction with the word economic. This implies that a broad construction should be placed on the reference.

It is respectfully submitted that this was what was intended when the reference was drawn. An interpretation confined solely to dollar and cent returns would conflict sharply with established Government policy on water conservation and development now applied under the terms of the Prairie Farm Rehabilitation Act, in the low rainfall area of the Prairie Provinces.

It is pertinent to point out here, too, that the development of a nation's natural resources, of which land and water are the greatest of all, create new values—values which are constant and enduring—values which bring social returns in terms of human comfort and well-being. These are some of the intangibles that cannot be appraised on a mere dollar and cent basis. It is affirmed here that any appraisal that fails to take the human aspects into account is entirely unrealistic and unsound.

It is taken for granted that enough is known about the benefits of irrigation and the need for irrigation in the drought area to place irrigation in the forefront

as the most profitable and desirable use which can be made of the physical resources involved, namely, the land and the water.

It is submitted further, that the drought area—the so-called "*Palliser Triangle*"—of the open plains, is a weak link in the agricultural economy of the nation.

This is evidenced from time to time, over the period of settlement, by relief grants, seed grain advances, Prairie Farm Assistance payments and other forms of Government aid, Provincial and Federal.

It is evidenced, too, by abandoned farms and a general thinning of the population resulting from periods of severe and protracted droughts.

This being the case, obviously, the expenditure of funds from the National Treasury designed to ameliorate these conditions, is good business and sound public policy. Particularly when we reflect that the alternative to that policy is to go on paying out large sums of public money for the relief of distress without getting anything in return.

Moreover, in addition to the physical resources there are the human resources involved. No nation can afford to overlook the human factor.

Too well we remember the great drought of the thirties, which for severity and duration, was unprecedented in the records of active prairie settlement. Scores of millions of dollars of public money had to be spent for the relief of distress and for the different forms of agricultural aid in the afflicted area.

The deterioration in living standards and public morale, which the disaster of that period imposed, are all of record and need not be further elaborated upon here. (See Report on Rural Relief due to Drought Conditions and Crop Failures in Western Canada, 1930-1937, by E. W. Stapleford.)* Suffice to say, the drought, with its accompanying "*black blizzards*", created a human problem of major proportions.

The irrigation districts in the Province of Alberta were as an oasis in a desert during all those terrible and tragic years. It was fully realized, at the time, that the expenditures on relief were only a temporary measure at best. Consequently, a more permanent solution to the problem was sought. To this end, the Prairie Farm Rehabilitation Act was passed by Parliament in 1935.

In the mid-thirties the writer became a member of the Relief Committee of the Provincial Government. We had to go, year after agonizing year, hat-in-hand to Ottawa begging for money for the relief of distress and even for money to pay the day-to-day expenses of Government.

*Copies filed with this report.

During one of these visits to Ottawa, after we had concluded our grievous business, at a meeting with the Government, the writer was standing chatting with the late Prime Minister Right Honourable W. L. Mackenzie King. As if thinking out loud, he enquired as to how long I thought the desperate situation would last. Is there nothing we can do, he asked, of a more permanent nature to relieve the terrible situation? I replied that there was, but that such measures, to be reasonably effective, would take both time and money. "Undoubtedly", he replied. Then he made the further significant statement that he thought it was time we were getting started with some large-scale projects designed to meet the situation in a more effective and permanent way. Those were, in substance, Mr. King's words on that occasion as near as memory serves to remember.

It was in that favourable climate that the Prairie Farm Administration began growing up.

The present Federal Minister of Agriculture, Right Honourable J. G. Gardiner has, over the years since, increased the powers and greatly enlarged the scope of the P.F.R.A. in an effort to meet the drought conditions that prevail in the prairie region.

One of the most important and far-reaching measures, in this regard, was the introduction of the policy whereby the Federal Government assumed the costs, on a non-recoverable basis, of large dams, main canals and other capital works, thereby insuring that the lands benefited would not be saddled with costs that these lands could not bear.

The principle is generally accepted now that the development of the land and water resources of a country confer general benefits, consequently all should bear some share of the costs of such development. It is respectfully submitted, therefore, that if consistent policy is to be followed, this principle should also apply to the proposed development, and the questions submitted in the reference should be considered in their broadest long-range aspects. The point that should be stressed is that the proposed project should not be considered as a separate or isolated case, but rather as part and parcel—which it is—of a comprehensive basin-wide development designed to meet the hazards of recurring droughts and for the rehabilitation of the people resident in the area in so far as that objective can be achieved by the conservation and utilization of available water resources.

When the programme now envisaged is carried out in its entirety, there will be a green belt of approximately 2,000,000 acres right through the heart of the so-called

triangle, stretching all the way from Cardston, Alberta, to Saskatoon in Saskatchewan—a distance of 350 air miles.

Wasting a Great Resource

Herbert Hoover is the authority for the statement that "*every drop of water that runs to the sea without rendering a commercial return is a public waste*". As this question of waste in the matter of a natural resource has an important bearing on the matters raised in the reference, it is pertinent to point out that the potential possibilities of the proposed South Saskatchewan River Development is tremendous.

It is affirmed here, that every day, indeed with every passing hour, that the construction of the project is delayed the Nation is sustaining economic loss. It has been said that water is "liquid gold" on the dry prairies. The question is, then, how much of this precious life-giving asset can we afford to waste.

It is affirmed here, too, that our agriculture is not fully developed as long as great stretches of fertile lands lie parched and largely unproductive, while a great river flows waste through the very heart of these lands to the ungrateful sea.

An Unbalanced Agriculture

In giving consideration to the economic and social aspects to which the reference directs special attention, due account should be taken of the fact that the agricultural economy of the Province of Saskatchewan is unbalanced to the degree that it is dependent on wheat—or a one-crop system of farming.

The area of scant or low rainfall embraces approximately 100,000,000 acres, or more than three times the size of the Maritime Provinces. Over sixty per cent of this scant rainfall area lies in the Province of Saskatchewan.

Such an immense area, by reason of its agricultural instability, has presented a problem of the first magnitude to the Nation. In order to maintain a balanced agriculture, adequate supplies of feed and fodder for the maintenance of livestock is an essential requirement.

Broadly speaking, the conditions common to the low rainfall area are more favourable to cereal crop production than they are to a more diversified agriculture. The lack of native grass-land pasture in another handicap in this regard.

While it is correct to say that our great grass-land areas support a livestock economy, and we rightfully boast about the quality of our "grass-fed steer", it is nevertheless a fact that the great bulk of our range-bred cattle and lambs are dumped on the markets every

fall in an unfinished condition. This represents not only a loss to the producer but also a great loss to the economy as a whole.

Obviously, the economy would be strengthened to the degree that this annual loss could be reduced or eliminated altogether, by a policy of feeding and fattening on the ranches, farms and in the feed lots. In the Lethbridge area the feeding and fattening of livestock has reached the proportions of a major industry. Over 75,000 head of cattle and 60,000 lambs were fattened in the irrigation districts during the feeding season of 1950 and 1951.

The feeding and finishing of livestock is a natural industry which automatically grows up and prospers with irrigation farming. The reason being that irrigation districts are a dependable source for abundant supplies of high-grade feed-alfalfa and the like.

Ranching and irrigation farming are complementary enterprises, each contributing to the prosperity of the other. The combination insures maximum returns to the rancher from his grass-land acres in pounds of meat—and therefore dollars—while at the same time affording a ready cash market to the farmer for his hay and grain crops.

There is no livestock fattening enterprise in Saskatchewan on a scale comparable with that in effect in Southern Alberta. This undesirable condition will continue until we have large-scale irrigation systems operating in the Province. It cannot be otherwise, although we have the livestock and grass lands in abundance. We have also an organization in the form of community pastures providing an ideal set-up for such an enterprise. What we lack is an abundance of good feed, which only irrigation can insure.

The greatest disability of all to the livestock industry in the low rainfall area, and it applies to the small stockman and farmer as much—if not more than—it does to the large stockman and rancher, is that the industry is insecure by reason of the fact that when drought strikes, crops fail and the farmer is forced to dispose of his livestock often at sacrifice prices.

This happened on a large scale during the great drought of the thirties. During that distressful period even the foundation herds had to be sacrificed. There can be no stability in the industry where these conditions exist, because there is only time to build up one good herd of cattle in a lifetime.

True, only a small percentage of the dry plains can be irrigated from the available water supplies. The fortunate circumstance is that the stabilizing effect of irrigation extends far beyond the area under the ditch. The belief is widely held, and shared in by leading Agri-

culturists, that under the climatic and soil conditions common to the Western Prairie Region every acre irrigated will stabilize 20 acres of adjoining dry lands.

Public statements in support of this view have been made by E. L. Gray, Superintendent of Water Development, P.F.R.A., and formerly General Manager of the Eastern Irrigation District, Alberta, and by E. E. Eisenhauer, C. E. & I.E., B.Sc., Deputy Minister of Public Works, Saskatchewan, formerly Irrigation Specialist, Lethbridge Northern Irrigation district, Alberta.

If conditions can be said to be comparable as between one area and another, then the conditions in the Brooks District are very similar to those of the proposed development area in Saskatchewan.

Mr. Gray is on record as stating that in the Brooks area, with 100,000 acres under the ditch, the Eastern Irrigation District has established a good range and dry land economy on 2,000,000 acres of adjoining lands.

Fortunately we do not need to go far afield to get an example of the stimulus which irrigation provides for the livestock industry. We have a good example in our own Province. At Val Marie, in south western Saskatchewan, where 4,000 acres have been under irrigation for upwards of 12 years, the cattle population has increased within the development area from 250 head in 1939 to over 4,000 head in 1941.

Instead of depending upon the problematical "big crop next year" philosophy, the farmers of the district enjoy a steady yearly income from their farming operations. Perhaps one of the most striking example of what has been accomplished in the Val Marie district is that in 1937 a train load of feed was shipped all the way from Eastern Canada to Val Marie as an agricultural relief measure. In 1943, a train load of lambs was shipped out of the same district—lambs that had been fed and fattened on the crops grown on the irrigated lands.

While the quality of the native prairie grass is highly nutritious, the production in pounds of beef on a dry land acre is very low compared with an acre of pasture under irrigation.

Research by the Lethbridge and Swift Current Experimental Stations has determined that one acre of dry land pasture will only produce $8\frac{1}{2}$ pounds of beef. The same acre of pasture land under irrigation will produce from 400 to 600 pounds of beef. In other words, irrigated pasture lands will produce fifty times the return in pounds of beef per acre than will the same acreage of dry lands.

It is hard to visualize the impact which the production from half a million acres of land under irrigation would have on the economy and social structure, not only of the Province, but on the country as a whole. Certainly it would be tremendous!

The case for the proposed South Saskatchewan River Development can be put in a single sentence. Experience over the years has shown conclusively that the construction of *large-scale* irrigation projects in the Province of Saskatchewan, such as that proposed, is long over due both from the standpoint of social welfare and the agricultural economy as a whole.

Allied Industries

The production of "specialty crops" under irrigation creates conditions favourable to the establishment of secondary or allied industries.

There has been a marked trend in this direction in southern Alberta where three sugar factories, three canning plants and other food processing enterprises have been established—all based on the raw products of the farm.

This development, together with the live stock fattening enterprise already mentioned, serves to show the complementary relationship between factory and farm which irrigation provides in such large measure.

A statement showing this relationship was compiled by Mr. Harold G. Long, General Manager of the Lethbridge Herald Company Limited, February 1951, under the title "*South Alberta Irrigation Production Facts*". A copy of this statement is attached as Annex I to this submission. There is no occasion, then, for guess work or idle speculation in these matters—the results speak for themselves.

In the proposed development area in Saskatchewan the soil and climatic conditions are similar to those of the irrigation districts in southern Alberta, where these secondary industries have sprung up and are now contributing millions of dollars annually to the economy of the province.

It all adds up to growth and progress creating new wealth, new opportunities in the trades and professions, and a higher standard of living for all the people.

Beyond all doubt, therefore, there is economic justification for proceeding in an orderly and expeditious manner with the construction of projects designed to put to full economic use all available water resources, not yet utilized, for the dry but fertile lands of Saskatchewan.

The Population Factor

For a decade or more the Province of Saskatchewan has been losing population. This is particularly true of the rural areas.

Dry land farming, as now practised, is to some extent at least accountable for this undesirable condition. Irrigation farming, on the other hand, has the opposite effect in that it favours close settlement and attracts people to the land and rural communities.

In the irrigation districts of southern Alberta this trend is very marked. In the Taber district, according to a statement made by Mr. Ted Sundal, secretary of the Taber Irrigation District, to the St. Mary and Milk Rivers Water Development Committee*, there is a population density of approximately one person to each 10 acres. This population density works out at nearly twenty times that of the dry land areas. These are astounding figures. It is only right to say, in this connection, that the figures represent one of the most highly developed irrigation districts in southern Alberta. This circumstance, however, in no way detracts from its value as an example of what can be accomplished under irrigation.

The density of the population in the Taber area is due entirely to the increased production and greater prosperity that has been brought about by irrigation. The natural conditions in the Taber area are not more favourable to the development of irrigation, from a soil and climatic standpoint, than are the conditions in the proposed development area of Saskatchewan.

In the light of the remarkable achievements of irrigation in the Taber and Lethbridge areas, it is right to say that, to make a proper evaluation of the future possibilities of irrigation in one area with another similarly situated, limits should not be set short of those imposed by the climatic and soil conditions. Allowing for the time factor, what can be done in one area can be done in another.

Costs

The key structure in the proposed development is a high dam across the South Saskatchewan River at the Coteau site. The question has been raised that the project may not be economically feasible because of the high cost of the main structure. This is not necessarily the case. Compared with other projects of the kind, good reasons can be advanced to show that it is not the case.

*Four copies of the Report of this Committee are filed with this statement.

In an earth-fill dam, of the type proposed, one of the principal cost factors is the availability of suitable material—impervious material (clay) and pervious materials (sand and gravel and rock for rip-rap). All these materials are readily accessible at the Coteau site. This circumstance was one of the determining factors for the selection of the site in the first place. Modern earth-handling equipment makes the placing of this *on-site* material a comparatively low cost operation.

Suitable topography for a spillway, together with conditions reasonably good for the construction of outlet works and a flooded area that can be acquired at a negligible figure, are all factors that should contribute to keep construction costs down.

In determining a site for a structure of the magnitude of the proposed Coteau dam, a great deal of investigation and study was necessary and many factors had to be taken into account, including those already mentioned. All of which combine to make the Coteau site almost ideal for what was intended.

It is right to assume, therefore, that those natural advantages will be reflected in lower costs. Certainly, there is no good reason for the view that the costs will be inordinately high. True, construction costs have gone up all along the line. Put in the language of the street, "who cares about that". Values are, after all, only relative.

The great need is for more production. More of everything—particularly food. The world is crying for its daily bread.

One way of achieving more production is by investment in productive works—which is exactly what the proposed development is—an investment in the future.

There is another important aspect that needs to be stressed. A nation's soils and waters are by far its greatest natural resources. It follows, therefore, that money spent in the development of these resources have a much broader basis for justification than that which governs private enterprise. These are inescapable reasons why this should be so.

The spending of public funds for the development of a natural resource rests on the broad base of extended public benefits—not the least of which is human welfare and happiness. These are human values, none the less real because they are intangible; none the less enduring because they cannot be appraised in mere dollars and cents in the profit and loss columns of a ledger. It is affirmed that a niggardly economy should not prevail over the forces of progress.

Considered on this basis the question that overrides, in importance, that of immediate or first costs is: does the proposed development prejudice future developments in the overall plan? A question to which a categorical answer can be given—that it does not.

The Safety Factor

Something has been said about the safety factor. The words "*disturbing features and obvious risks*" have been used in connection with the project.

In harnessing the illimitable forces of nature, risks have to be taken. It is respectfully submitted, however, that the risks involved in the case of the proposed dam on the South Saskatchewan River are no greater than have been, or are being, taken every day with similar projects in many places all over the globe.

The question that has to be determined is: can the risks be eliminated or reduced to insignificant proportions. In the particular case under consideration, it is believed that the risks have been assessed and provided for. There are engineering skills and experience to support this belief. The principles of soil mechanics are basic to almost all branches of civil engineering and particularly to the design and construction of earth dams.

Earthen dams, properly designed and constructed, provide a margin of safety comparable to that of similar structures built of concrete or other materials.

The writer can speak from first-hand knowledge as to the experience of P.F.R.A. engineers with the design and construction of earth dams. The P.F.R.A. operates the most up-to-date and best equipped laboratory in all of Canada. This laboratory is staffed with highly qualified and competent engineers and technicians. It is right to say, too, that P.F.R.A. engineers are specialists in the construction of earth dams. That is their day to day business. No other group of engineers in the country have had so much experience. The St. Mary dam, the largest rolled earth-fill dam in Canada has just been completed. This dam was designed and constructed solely by P.F.R.A. engineers. But this is not all. Outstanding consultants have been employed. Dr. J. A. Allan, M.Sc., Ph.D., F.R.S.C., has been with the project as consulting geologist, since its inception in 1943.

Dr. Allan is a recognized authority on the geology and physiography of the Canadian Rocky Mountains and the Western Canadian Prairies. He has made detailed studies of the Saskatchewan River Valley from Red Deer to Saskatoon.

Harley B. Ferguson (retired) Corps of United States Engineers, senior consultant, was employed as early as 1946. Major General Ferguson has filled many

important positions in connection with engineering in his own country and abroad. He has been a member of numerous engineering boards, including the St. Lawrence Waterway. General Ferguson was president of the Mississippi River Commission for seven years, 1932-1939. He has had a great deal of experience with alluvial rivers, the Ohio River, Tennessee River, Lower Mississippi River and the like.

Dr. A. Casagrande, another consultant, is recognized as an international authority in soil mechanics and foundation conditions. Dr. Casagrande acts as consultant to the United States Corps of Engineers. He has been consultant to the Government on some of the most important construction works in the United States.

In Canada he serves as consultant to the Shawinigan Engineering Company and the Steel Company of Canada.

Last but not least, L. F. Harza, president of the Harza Engineering Company, Chicago, and present day Dean of American Hydraulic Engineers, has been called in as another consultant.

Mr. Harza is chairman of the consulting board of the Damodar Valley Corporation, India. He spends one month out of every four in that country. In addition to acting as a consultant to Governments and corporations, Mr. Harza has been engineering large projects for forty years. His dams and power-houses are found in every part of the U.S.A. and also in many places abroad.

(See further qualifications and experience of these engineers in Annex II).

All these eminent engineers have pronounced themselves *in writing that an earth-fill dam at the proposed Coteau site is a feasible undertaking.*

Dr. Casagrande fortifies his statement as to feasibility with the observation that *"this is proven by the construction of similar works in similar material in the United States"*.

It will be seen, therefore, that all these outstanding consultants have endorsed the findings of P.F.R.A. engineers.

On the Missouri River, where conditions are comparable with that of the South Saskatchewan River, there are four big dams, three of which are much larger than the proposed Saskatchewan River dam. These dams are all of the same type as that proposed by the P.F.R.A.

Fort Peck, one of the largest earth dams in the world, is 242 feet high; further down on the main stem of the Missouri River is the Garrison Dam, a rolled earth-fill dam 12,000 feet long. This dam is now nearing completion. It is approximately the same height as the

proposed Coteau dam in Saskatchewan. Foundation conditions are almost identical. Still further down the Missouri River is the Oahe and the Fort Randall Dams—in that order, all earth-fill dams and from Fort Peck down, each contributing to the hazard of the other—if there is a hazard.

No one, so far as the writer has been able to ascertain, is worrying about the risk in spite of the fact that great cities like Omaha, Kansas City and other large urban communities, situated in the Missouri Valley, lie below the great reservoirs created by these gigantic structures. Instead of worrying about the risks, they are pleading with their Congress for more of these huge projects as *further* protection from the flood hazards of the great Missouri River.

All in all, then, it is reasonable to conclude that like their United States counterparts P.F.R.A. engineers have taken all the necessary precautions to insure engineering feasibility with a maximum of safety in the construction of the proposed Coteau dam.

No Alternatives

It is noted that in the second indented paragraph of section one of the reference the question is raised as to whether the project "represents the most profitable and desirable use". The answer is that it does—for the following reasons.

The proposed development is a *multi-purpose* project embracing irrigation, power, flood control, maintenance of lake levels in the Qu'Appelle Valley and Long Lake, domestic water supply for the cities of Moose Jaw, Regina and intermediate points, recreation, tourist attractions and other uses.

Large sums of money have been spent, over the years, on explorations and investigations in an effort to determine a site for a large project that would contribute most to the stabilization of agriculture in the area and at the same time meet the other objectives.

It is perhaps not generally realized how fully the prairie area has been, and is being, covered by P.F.R.A. engineers and agricultural field men. Never before has there been such a thorough examination of the conditions from an agricultural and economic standpoint. These agricultural field men and engineers, Provincial and Federal, have literally lived with the contemplated development for years.

It is, therefore, extremely unlikely that an alternative to that which is now proposed can be found at this late date.

Summary

The following summary is advanced in support of the proposed project:

1. The physical aspects of the proposed South Saskatchewan development are confined exclusively to the Province of Saskatchewan. The operation of the works does not depend on outside co-operation.
2. As the development is all contained within the boundaries of one province, the practical difficulty of two separate administrations is thereby avoided.
3. The point of diversion is in close proximity to the irrigable areas, hence water losses and wastage in transportation are reduced to a minimum. Maintenance of the system is also correspondingly reduced.
4. The location of the proposed dam near the mouth of Coteau Creek provides the most feasible and economic means of bringing water to the dry areas situated on both sides of the River.
5. A high dam at the proposed site affords the most central location for the generation and distribution of hydro-electric energy in the Province.
6. The site provides the greatest and the most economical storage on the South Saskatchewan River.
7. Existing storage, for power purposes, above Calgary operate to insure greater winter flow in the river and hence to increase the power potential at the proposed site.
8. A high dam at the Coteau Creek site on the main stem will collect all the water from all the tributaries of the South Saskatchewan River.
9. The flow of the South Saskatchewan River, together with the available storage at the proposed dam site, will insure the generation of more firm power than can be obtained at any other site on the South or North Saskatchewan Rivers systems.
10. Live storage of 4,000,000 acre-feet in the proposed reservoir makes other potential power sites further down the river economically feasible.
11. The 4,000,000 acre-feet of storage which can be provided by the construction of the proposed project, affords the best regulation obtainable on the river.
12. The storage provided by a high dam at the Coteau Creek site will afford a greater measure of flood control than would a similar project situated elsewhere.
13. The site of the proposed dam and reservoir provides the best location from which to secure an adequate water supply for the cities of Moose Jaw, Regina and intermediate points.
14. The site of the proposed dam and reservoir provides the best location for augmenting the low water flow in the Qu'Appelle and Assiniboine Rivers and for maintaining water levels in the chain of lakes situated in the Qu'Appelle Valley and Long Lake.
15. A high dam at the proposed location will serve the greatest amount of dry land in the Province of Saskatchewan with the least losses of water in transportation.
16. The site provides the only feasible means of providing an adequate water supply for irrigation and other purposes in the Qu'Appelle Valley.
17. The Outlook area, which would be served by this project, receives less precipitation than *any* area now served by irrigation on the prairies. (See B. W. Currie Report—October, 1949).
18. One of the human aspects of the proposed development is that from the available water supply a greater number of people, presently situated in the drought area, can be served by this project than would be the case if the project was located elsewhere.
19. The project will serve an area that has been built up with railroads, highways, schools, churches, hospitals, and the like, but the area has been steadily losing population because of recurring droughts.
20. Saskatchewan's prosperity, more than any other province, is dependent on dry-land agriculture. Many crop failures by drought place Saskatchewan's agriculture on an unstable basis. The central Saskatchewan area presents an especially serious and baffling problem in this regard. The proposed project will go a long way towards stabilizing agriculture over a large part of the province.
21. The proposed development will provide opportunities for resettlement and rehabilitation of settlers presently situated on submarginal land. In this an additional purpose will be served in that the sub-marginal lands can then be put to their best economic use—namely, community pastures.
22. There is no similar low-rainfall area, in all the prairie region, where so much good land can be irrigated from an available water supply in such close proximity thereof.

23. Because of its favourable location, and for other reasons, the project lends itself particularly to the development and stabilization of the livestock industry.
24. Large-scale irrigation in the area will stabilize farming and ranching in the country surrounding the irrigation districts to an extent many times greater than the area actually under the ditch.
25. The introduction of irrigation into the proposed development area would mean a substantial increase in the population. (See Summary Report "South Saskatchewan River Project—1951"; also "St. Mary and Milk Rivers Water Report—1942"; also "More Farmers for Western Canada", 1941, by Andrew Stewart, Pres. University of Alberta.)
26. When the *Basin Development* (overall-plan) now envisaged is completed a new day will have dawned for the people resident in the drought area—a new era born for Western Agriculture.

Conclusion

Droughts have been coming to the great plains for centuries on end. We have been fortunate in that we have had a succession of good years, twelve or more in a row—time may be running out.

The writer ventures to say that no one who lived through the great drought of the thirties can ever forget the hardships and the tragedy of that period, or remain indifferent to measures designed to better the situation.

It is believed by the writer that this Commission has a proper appreciation of the situation. It is believed, too, that the Commission has the courage and the vision to approve these measures.

In short, it is felt that the Commission would not want to be remembered in history as having stood for even *one day* in the path of progress.

ANNEX I

SOUTH ALBERTA IRRIGATION PRODUCTION FACTS

by Harold G. Long

Compiled February 1951

Canadian Sugar Factories Ltd.

3 factories, at Raymond, Picture Butte and Taber.
Have capacity to process over 525,000 tons beets annually, or enough to yield 150,000,000 pounds of sugar.

1950 Operations of Sugar Factories Only

Full-time employees—	225.
Part-time employees—	900.
Payroll—	\$1,327,000.
Sugar Production—	123,802,300 pounds.
Value of Sugar at Factories, approx.	\$13,000,000
Molasses	300,000
Wet Pulp	75,000
Dry Pulp	400,000
	<hr/>
	\$13,775,000

Crop grown last year by 1,550 farmers on 37,099 acres.

Crop harvested from 36,172 acres.

Tonnage of Beets—445,164 tons.

Expected Minimum price—\$15 per ton.

Gross Value of Beets \$6,677,460

Value of Tops 500,000

\$7,177,460

About 7,500 persons given seasonal employment growing beets, this including children of farmers and parents with beet labour contracts.

Livestock Feeding this season

Over 75,000 head of cattle (up from 40,000-50,000 pre-war).

60,000 lambs (down from 150,000 pre-war).

It is generally accepted that about 30,000,000 pounds live weight of beef and lamb are produced each winter feeding season in feedlots in irrigation areas—worth (at present fantastic prices about \$9,000,000).

Vegetable Canneries

Plants at Lethbridge—Broder Canning Co.

Taber—Cornwall Canning Co.

Magrath—Alberta Canning Co.

Also Canada's largest vegetable quick-freeze plant operated in Lethbridge by Broder Canning Co.

Plants process corn, peas, beans, carrots, soup mix, pumpkin, red table beets.

Employed by all plants:

about 100 men and women full-time,

about 1,100 part-time.

Payroll about \$300,000 per year.

Gross market value of processed vegetables ranges from \$3,000,000 to \$5,000,000 yearly.

Growing of Pickling Cucumbers around Taber, for Dyson's

300 acres
 Average crop—1,000 tons
 Farmers paid—\$45 av. per ton
 Gross value to farmers—\$45,000

Special Crops

Growing of soft white Spring Wheat on irrigated land. (Wheat milled into pastry flour at Lethbridge, Medicine Hat and other cities).

Average acreage—30,000 acres.

Average production—1,000,000 bushels.

Price to Growers for 1950 crop—\$1.55 to \$1.60 per bu.

Expected to be at least the same this year, or total to growers about \$1,600,000.

To mill this crop in one plant would require mill employing 50 people for one year and annual payroll of over \$100,000.

Fresh vegetables grown in irrigated areas around Lethbridge have annual value to farmers of \$500,000.

Corn on the cob, peas, carrots, turnips, cabbages, cucumbers, celery.

Forage Crops

Hay: None for shipment—all now fed in projects.

Alfalfa: At one time made up 20-25 per cent of all irrigated acreage and much shipped out. Acreage now smaller due to alfalfa wilt disease and all grown is used by livestock feedlots.

Timothy: Little grown since horses went out of fashion.

Sweet Clover: Mostly grown as green manure crop preparing land for beets and canning crops.

Potatoes

Potatoes for commercial purposes in 1950:

Grown on 7,000 acres irrigated land.

Production suitable for marketing purposes—28,000 tons.

Because of over-supply average value of crop \$25 per ton.

Average of 1949 crop was over \$40 per ton.

*Seed crops**Seed Peas*

(Acreage and price fluctuate with world requirements).

Average 5,000 acres

Average Yield 800 lbs. per acre—total 4,000,000 lbs.

Market Value—over \$500,000

Value to farmers—\$260,000

Farmers paid now 5½ cents to 7½ cents per lb.

Several companies issue contracts, including:

O'Loane Keily and Co. Ltd., Broder Canning Co., and Ellison Milling & Elevator Co., all of Lethbridge.

Commercial Mustard Seed

Will become big thing on irrigated farms this year as result of experiment last year when 215 acres averaged 1,000 lbs. per acre compared with 300 on dry land.

O'Loane Keily & Co. and Ellison's will contract as much as possible on irrigated land this year, possibly (if can persuade farmers) 7,000 to 10,000 acres.

Farmers paid 7 cents per lb. for yellow variety, 5 cents per lb. for brown variety.

Tomato Possibilities

Depending on ability of plant scientists to "tailor" commercial canning tomato and if growers to grow it successfully, could *double* present total acreage in canning crops. Will need tomato acclimated to short South Alberta season and "know how" on part of growers to succeed. May require "smudge pots" to fight first mid-September frosts. Irrigation men hopeful new area of light soil land east between Taber and Medicine Hat will grow both tomatoes and field corn successfully.

Other Industries

Various industries directly established because of irrigation.

Manufacturing land levellers, sugar beet harvesting machines, packers, together with several service industries serving the irrigation farmers especially. All just starting up.

Major Aluminum Co. has opened warehouse and assembly plant in Lethbridge for sprinkler systems.

Numerous industries and businesses in and about Lethbridge developed because irrigation increased productivity, enabled the same areas to support larger populations.

Land Values

	Value of Irrigated land per acre	Value of Dry land per acre
Taber	\$250 to \$350	\$ 5 to \$50
Coaldale	\$100 to \$200	\$25 to \$80
Lethbridge Northern	\$100 to \$250	\$30 to \$80

ANNEX II

ALLAN, John Andrew—M.Sc., Ph.D., F.R.S.C.

University professor (emeritus); consulting geologist;

Born Aubrey, P.Q., July 31, 1884;

Educated McGill University, B.A. 1907; M.Sc. 1908; Mass. Instit. of Tech., Ph.D. 1912;

Professor of Geol. and Mineral. and Head of the Department, University of Alberta; field geologist, Canadian Geological Survey 1906-18; Since 1918 Provincial Geologist, Province of Alberta;

Dr. Allan has done extensive studies and written numerous authoritative reports on structural geology and physiography of the Canadian Rocky Mountains and Western Canadian Prairies. These studies include a detailed study of the Saskatchewan River Valley from Red Deer to Saskatoon. He has been consultant on engineering geology for power plans and other projects in Alberta.

Member Canadian Institute of Mining and Metallurgy (Pres. 1932-33); Member Engineer Institute of Canada; Member Assoc. of Professional Engineers of Alberta (Pres. 1930);

Address: 11138-90th Avenue, Edmonton, Alberta.

FERGUSON, Harley Bascom

Army officer; born Waynesville, N.C. August 14, 1875; son of William Burder and Laura Adelaide Ferguson; graduate U.S. Military Academy 1897, Staff College, Fort Leavenworth, Kansas, 1904, Army College 1921, married Mary Virginia McCormack January 3, 1907; children—Adele, Virginia. Commissioned 2nd Lieutenant Corps of Engineers, U.S. Army, June 11, 1897, and advanced through grades to Brigadier General 1932. With engineer troops in Cuba 1898, Philippines 1899, Chief Engineer China Relief Expedition 1900; Brigadier General Chief Engineer 2nd Army Corps, France, World War. Dist. Engineer Montgomery Ala., 1907-09; executive officer in charge of raising Battleship Maine, 1910-11; Dist. Engineer Mil-

waukee, Wis., 1913-16, Pittsburgh, Pa., 1920. In charge organization industrial mobilization office, Assistant Secretary War; Director Army Industrial College, 1921-26; division engineer Gulf Division, New Orleans, 1928, Ohio River Div., Cincinnati, including Tennessee River 1928-30, South Atlantic Div., 1930-32, Lower Mississippi River Div., and President Mississippi River Commission, 1932-39; member special engineer boards, Rivers and Harbours, 1930-32; St. Lawrence Waterway 1931-32, Muscle Shoals, Delaware River, Lexington Dam, Harvey lock, Mouth Columbia River, Mouth Mississippi River. Retired from active service with rank Major General, 1939.

From: "Who's Who in America".

CASAGRANDE, Arthur

Born—August 28, 1902, in Hardenschaft, (Old Austria) Italy.

Educated in Austria, culminating in degree of Doctor Tech. from Technical University, Vienna, Austria, 1933. Honorary degree, A.M., conferred by Harvard University, 1942.

Experience—Draftsman, D.P.W. Loeuwarden, Holland, summer 1922.

Jr. Eng., Tunnel construction in Austria Alps, summer 1923-25.

Asst. in Hydraulics & Sanitary Eng'g, Technische Hochschule, Vienne, Austria, 1924-26.

Draftsman, Carnegie Steel Co., Newark, N.J., 1926.

Pvt. Asst. Prof. Terzaghi, 1926-30.

Research Asst. U.S. Bureau of Public Roads, 1926-32.

Lecturer on Soil Mechanics, Graduate School of Engineering, Harvard, 1932-34.

Asst. Prof. Civil Eng'g, 1940-46.

Prof. of Soil Mech. & Foundation Eng'g, 1946. Consulting Engineer, War Dept. and numerous State, Municipal & Pvt. Engineering Organizations.

Private Consultant, 1932.

Consulting Engineer, War Department 1936.

Panama Canal, 1940.

Courses for Engineer Officers, Harvard, 1942-44.

Clemons Herschel prize and Fitzgerald medal.

Boston Society of Civil Engineers.

Dr. Casagrande served as principal assistant to Dr. Terzaghi in the development of many of the principles of soil mechanics. In conducting research, teaching, and applying his knowledge to practical problems in the field of soil mechanics

and foundation engineering as a consultant. Dr. Casagrande has become a leading authority in the field. This is indicated by the fact that Harvard University, where he is professor of Soil Mechanics and Foundation Engineering is recognized as the leading school in soil mechanics on the American continent, and that Dr. Casagrande is retained by the U.S. Corps of Engineers as consultant on soil mechanics and foundations on all their major projects. Specifically, he is on the Board of Consultants for the following dam projects:

Garrison, Fort Randall, Oahe, Chief Joseph and Mud Mountain. He also served on the board that investigated the slide at Fort Peck, and has served as consultant on the slides on the Panama Canal and the investigation on the proposed Sea Level Canal. He made notable contributions to the solution of problems in the construction of airports during the war; particularly in connection with Logan Airport, a project which involved the placing of forty million cubic yards of fill by hydraulic methods. This was a bold and original approach which was successful.

In addition, Dr. Casagrande's private consulting practice has put him in association with many of the most important construction projects in the United States. In Canada he serves as consultant for Shawinigan Engineering Company and the Steel Company of Canada.

HARZA, L. F.

L. F. Harza, president of the Harza Engineering Company of Chicago, has been taming rivers and putting them to work for more than 40 years. Present day dean of American Hydraulic engineers, his dams and power houses can be found in every part of this country—and in several places abroad. To make this fact plain, one need only recall the Dix River Dam in Kentucky, the Loup River power project in Nebraska, the Santee-Cooper power project in South Carolina, the power installation at Fort Peck, Norfolk and Bluestone dams and the Rio Negro development in Uruguay.

Today, although nearing 70, Mr. Harza is operating on a schedule of one month out of every four in India as chairman of the consulting board of the Damodar Valley Corp., that nation's version of our own TVA. With eight or nine dams to build and a legacy of hand labour operation to start with, Mr. Harza is setting out to mechanize the job and give India an example of American construction know-how at work.

Recent and current work includes jobs in the Philippines, El Salvador, Canada and Tacoma, Wash. And when and if the St. Lawrence power scheme gets under way, it may well be Mr. Harza's design that is used for the great Barnhart Island powerhouse—36 units of 55,000 kw each. He prepared contract plans and specifications for the Corps of Engineers in 1942.

Both a mechanical engineer (South Dakota State College) and a civil engineer (University of Wisconsin) Mr. Harza began his career in the busy office of Daniel W. Mead, but by 1912 he had established his own consulting firm. Under such able associates as Calvin Davis, Edward Fucik and Harza's son, Dick, the organization continues the hydraulic design pioneering that Mr. Harza set as its objective over four decades ago.

From: *Engineering News-Record*, April 26, 1951.

Submission of the Saskatoon Board of Trade made on behalf of its Members including all Classes of Business and Professions and on behalf of the Mayor and Council of the City of Saskatoon respecting the proposed Dam and Irrigation Project on the South Saskatchewan River near Outlook to the Chairman and Members of the Royal Commission

MR. CHARLES HAZEN

1. This submission is made on behalf of the merchants, manufacturers, professional men, farmers and all citizens of every walk of life in the City of Saskatoon and community. Although the proposed Dam and Irrigation Project near Outlook may be considered to be of primary concern to the farmers in the irrigable area and contiguous to it, yet we consider it to be of vital interest and importance also to the citizens of Saskatoon, and indeed to all of the Province of Saskatchewan.

2. We believe that the investigations made and opinions expressed by the officials of P.F.R.A., who surveyed and planned this project, and which were endorsed by eminent independent authorities in the fields of engineering, irrigation farming, soils, climatic conditions, agricultural economies and hydro-electric power are sound and conclusive and prove that the joint investment by the governments of the Dominion of Canada and Province of Saskatchewan in this development will be economically sound and bring lasting benefits not only to all those immediately concerned but also to this province and indeed to the whole Dominion.

3. The privation and distress which resulted from the periodic droughts which assailed the farm lands in the area known as the Palliser Triangle, and particularly that disastrous period in the thirties, brought forcibly to the attention of all thinking people the errors in settlement actively encouraged by the Government of the Dominion of Canada in the early years of this century. This alarming condition has hit the Outlook-Saskatoon area as severely as anywhere on the prairies. It is shown by an abnormally low average crop yield, by below subsistence level average incomes, by high direct relief costs and by reduction in population density that is much greater than the average for the province as a whole.

4. Practically all tillable land in this territory was once closely settled. All necessary services such as railroads, municipal roads and highways, elevators, towns and villages, churches, schools, doctors, dentists and hospitals were developed and built up. Reduction in population, and particularly in gross income, over all this territory is resulting in abandonment of churches and schools, loss of population in villages and towns, loss of revenue to railroads, banks, elevator companies, etc., insufficient tax money to properly maintain roads, hospitals and support medical services.

5. Benefits and improvements which have resulted from the development of irrigated areas in Alberta and on a small scale in South Western Saskatchewan have shown conclusively how sound planning and public financing can alter and elevate the economic, social and cultural life of an area. Reports have been submitted which prove that the climatic conditions, soil types and topography are as favourable in this Outlook-Saskatoon area as those being successfully irrigated farmed in Alberta.

6. We ask that the Government of the Dominion of Canada proceed with the construction of the dam at the earliest possible moment and that this scheme be developed to its fullest extent as rapidly as possible so that—

- (a) Hundreds of farmers now living in this area in difficult economic circumstances, often requiring public assistance, depressed and hopeless, may be restored to independence and to conditions where they may earn a good and satisfactory livelihood, where they and their families may enjoy some part of that living standard which we Canadians like to boast is at least the second highest in the world, when they may hold their heads high and be truly proud of themselves and the country in which they live.

- (b) Young Canadian men and women and new immigrants from the Old World, whose hope and desire lie in an agricultural life, may get a start at a good income earning farm on a scale they can meet instead of the hopelessly large investment necessary to go into dry land farming today.
- (c) Resettlement and close settlement of hundreds of thousands of acres may permit the economic development of a rural electrification program fed by hydro-electricity at rates lower than foreseeable costs of steam or gas turbine generated electricity.
- (d) Towns, villages, railroads, elevators, livestock distributors and processors, and banks may benefit and grow in size and strength by serving this increased population.
- (e) A fuller and richer community may provide the tax base for proper development of roads, telephones, schools and health services.

7. A closely settled and prosperous farm area will enable all the above mentioned benefits to develop and to make rural life attractive and enjoyable. Isolation will vanish and social life centering around restored and well supported churches will develop to benefit all. The possible power development, which is only auxiliary to the main purpose of the dam, being so strategically situated in relation to the large steam generating plants in the three main cities, will enable the building of a distribution grid system covering a large part of the habitable part of the province.

8. The provision of flood control is also an important benefit as in recent years annual floods have taken a large toll of property and livestock and delayed farming operations on quite considerable tracts of land.

9. The establishment of the large lake and the restoration of other large and small lakes to levels of better years will provide recreational opportunities and aesthetic benefits within easy driving distance for more than 50 per cent of the people of Saskatchewan. Water in the lakes, in the ditches and on the land will surely result in the development of trees and shrubs, and although no monetary value may be attached to this factor, it will make all of this area a better country to live in.

10. Saskatoon, with its population of 55,000 persons, exists primarily to serve the farmers of north central Saskatchewan and its welfare is directly dependent on their prosperity. The proposed irrigation area lies mainly within our normal service area. Its further deterioration will have serious consequences to us but its improvement in population density and prosperity through irrigation will be of immense benefit.

Mr. Chairman and Commissioners, we earnestly and hopefully submit that you will shortly report to and urge upon the Prime Minister and Government of Canada the immediate acceptance of the South Saskatchewan River development scheme and that it will be authorized and construction proceeded with forthwith.

SASKATOON BOARD OF TRADE

W. M. NOBLE
President

S. N. MACEachern
Commissioner

CITY OF SASKATOON

F. C. CRONKITE
Deputy Mayor

E. JOHNSON
Acting City Clerk

City of Saskatoon Submission by the Mayor and Aldermen of the City of Saskatoon to the Chairman and Members of the Royal Commission Respecting the Proposed Dam and Irrigation Project on the South Saskatchewan River Near Outlook

The Mayor and Aldermen of the City of Saskatoon have already endorsed a joint brief submitted by the Saskatoon Board of Trade urging the early construction of the proposed Dam and Irrigation Scheme on the South Saskatchewan River near Outlook.

It is not necessary to repeat in detail the arguments set forth in that brief. We would like to add, however, that the necessity of the immediate construction of the project should not be disregarded nor minimized because we happen to be in the midst of a series of bountiful crop years—this year's probably being the largest we have ever had in Saskatchewan.

The records of the past prove beyond doubt that we cannot hope to have these good crop conditions continue indefinitely. We are almost certain to have poor crop conditions in the years ahead and quite possibly we may have a repetition of those disastrous years in the 30's when not only the farmers but all the residents of the West in Villages, Towns and Cities suffered very severely. In fact, every citizen in Canada indirectly felt the blow.

The costs of relief in various forms would largely pay for this proposed undertaking. It is our understanding that this project may take ten years to complete in which case the cost should not be unduly heavy in any one year.

In our opinion, no time should be lost in carrying out this project as it is altogether likely that by the time it is completed and established, we shall already have had lean crop years and may be experiencing another major drought cycle.

The economy of the Prairie Provinces is mainly dependent on the growing of grain crops by dry farming methods, supplemented by the raising of livestock. In times of drought or near drought, both these sources of revenue are greatly reduced, resulting in hardship and suffering to both rural and urban residents.

With irrigation, not only will crops be more diversified, but they will be assured. The farmers of this five hundred thousand acre district, even in dry years, will not only have a good crop but they will also be in a position to supply feed for livestock in the surrounding dried-out areas.

Saskatoon is vitally interested in the carrying out of this project. The Outlook district is served by the wholesalers, manufacturers and other businesses in this City.

Our location, so close to the area, has given us the opportunity to observe and know the difficulties the people on the farms and in villages and towns have experienced because of lack of sufficient moisture for their crops. The prosperity of the surrounding territory means, of course, prosperity for the City of Saskatoon.

Mr. Chairman and Commissioners, on behalf of all the residents of the district involved as well as the citizens of Saskatoon, we hope that you will feel convinced of the necessity of the construction of this Dam and will recommend to the Government of Canada that this project on the South Saskatchewan River be carried out without delay.

Respectfully submitted on behalf of

THE CITY OF SASKATOON
(J. S. MILLS) *Mayor*
(J. ANDERSON) *City Clerk*

City Hall, Saskatoon, Saskatchewan,
12 September, 1952.

Submission to the Royal Commission Investigating the South Saskatchewan River Development by the Saskatchewan Association of Rural Municipalities

MR. S. DUFF NOBLE

Mr. Chairman and Members of the Commission:

This brief is prepared by and on behalf of the Saskatchewan Association of Rural Municipalities. This body has been in existence since 1907, when it was created to deal with matters of concern to the rural ratepayers of the Province of Saskatchewan. It has a membership of all the 299 Rural Municipal Councils of the Province and as such is eminently fitted to speak with that degree of confidence required at this time.

With such a widespread organization, coupled with the fact that it touches upon the interest and life of each and every rural ratepayer, it is important that we take the opportunity offered of presenting to you our considered opinions upon this so vital matter, that of the proposed South Saskatchewan River Development Project.

In presenting this brief advocating the early construction of the South Saskatchewan River Dam, our Membership is fully conscious of the now well established fact, that the economy of Saskatchewan, presently based chiefly upon the returns from one crop, that is, wheat, is one lacking the balance and security essential to the needs of the people. Recurring droughts, by the destruction of feed crops and pastures have in the past frequently threatened the livestock industry, which should be the stabilizing factor of our farm economy, and in consequence, the industry has not progressed as it should. During the 1930's, seed, feed grains and fodder, had to be imported from other Provinces and even the United States, and in one year, cattle were sacrificed at one cent per pound. The proposed South Saskatchewan River Dam would provide a sure crop area for feed and fodder, sufficient to provide a necessary stabilizing effect on the livestock industry of the whole province, besides providing an area, in which ample feed and water would enable farmers of the area to feed and finish livestock, which at present are sold to other Provinces and the United States for fattening and finishing. The losses at present incurred by our livestock industry in having to market unfinished cattle is a serious loss to the industry. The reports of the progress of the irrigation areas of the Province of Alberta, the large canning and sugar industries which have been developed, is sufficient evidence of the prosperity which would follow the completion of this project.

Apart from general endorsement of the project, our Association has a particular interest in the future of the rural residents of the eighteen (18) Rural Municipalities included in the development area. In this region, approximately 3½ million acres are occupied by a population of about 28,000, and of the acreage about 2½ million are under cultivation. It is estimated that from a half to three quarters of a million acres could be irrigated. It has been stated that 100,000 acres of irrigated land in the Brooks, Alberta project, supports a total dry farming area of 2 million acres. If this ratio is correct, the benefits to be derived from the construction of this dam could have incalculable value to the economy of central Saskatchewan.

The usual facilities for such an extensive area, that is, railways, highways, market roads, telephones, schools etc., together with other sources of service and supply are already established, but their continued existence upon a satisfactory basis is dependent upon either rainfall or impounded water. Failing these, then assistance from either Provincial or Federal Government in times of need is the only alternative in view. During the past 20 years the cost of maintaining this area through recurring drought periods is partially made up as follows:—

Direct Relief	\$ 3,240,543.
Winter Maintenance of Livestock ..	1,373,984.
Seed Grain & Feed	3,287,211.
Tax Cancellations D.A.D.A.	1,594,884.
P.F.A.A. Benefits (1939-1950)	10,214,159.
Total	\$19,710,781.

When to the above we add the cancellation of debt under Farmer's Creditor's Arrangement Act, the Provincial Mediation Board and mutual adjustments, for which figures are not readily available; and consider the losses sustained by the farmers themselves, we get a fair estimate of the need for the construction of the project at the earliest possible date. If also, as pointed out above, we can expect the benefits to extend to an area probably five times the size of the 18 rural municipalities immediately affected, we can also increase the above loss figures by the same ratio. As an indication of the unfavourable prospects of the area, we would point out that the townships comprising the 18 rural municipalities in the development area, have received Prairie Farm Assistance Act benefits on an average of 7 years out of 12 years (1939-1950). The maximum being 10 years and the minimum 4 years out of 12. On the basis of all these costs, it appears to this Association that the project would be justified. Only by a per-

manent policy of use of the tremendous water supplies which are available in the Saskatchewan River System, can the farm economy of Central Saskatchewan ever hope to become self-supporting.

Power and Water

The Province of Saskatchewan is at present reaching a stage where cheap power will be essential to the future development of its secondary industries, to keep pace with the growth and requirements of the cities, and to provide for the development of a major mining industry in the north. The benefits to be derived from this aspect of the Saskatchewan River Development Project will have a lasting effect on the economy of the Province. It is also stated that the project will provide an increase in the power available at other sites on the river.

The provision of water supplies to the Qu'Appelle Valley system and the cities of Regina and Moose Jaw are also matters of major importance to the Province which we are sure the Commission will evaluate.

Conclusion

The Saskatchewan River Development Dam will be of major benefit to the development area, after the initial difficulties which might be expected, have been overcome, and the full development of the benefits to be derived have been fully realized. The Province as a whole can expect to obtain considerable assistance in the increase in population, production, and the easing of the burden of assistance in times of need. These same benefits will apply to the Dominion as a whole and it is estimated that the financial returns will approximate \$5,000,000 annually, or sufficient to cover the annual capital and investment costs based on the original estimates. Even with considerable increase in present day construction costs, it is desirable and necessary that the project be proceeded with at the earliest possible date, to avoid future heavy losses such as have occurred in the past.

Finally may we sum up the points we have tried to bring to your attention:—

1. The present economy of Saskatchewan, based on one crop, wheat, is dangerous and unsatisfactory.
2. Recurring droughts have retarded growth of the livestock industry.
3. A sure crop area and ample water would create a finishing industry in livestock and obviate present losses in marketing unfinished stock.

4. New industries, such as sugar and canning would likely develop, increasing population and production.
5. The development area with approximately three quarters of a million acres under irrigation, would improve the situation in an area of 14,000,000 acres of dry farming.
6. Continued existence of the whole of Central Saskatchewan as a dry farming industry will require Dominion, Provincial and Municipal assistance, and will also likely result in further losses by credit institutions.
7. P.F.A.A. record shows that only a permanent policy of use of available water supplies, will place Central Saskatchewan Farm Industry on a satisfactory basis.
8. Power and water supplies which can be developed by this project are necessary to Saskatchewan economy, as a whole, to assure development of other industries and to place the cities of Moose Jaw and Regina in the position of having ample water supplies which are necessary to their health and welfare.

Submitted by and on behalf of

The Saskatchewan Association
of Rural Municipalities.

S. DUFF NOBLE,
President.

S. FERGUSON,
Secretary.

August 29th, 1952.

A Statement Presented to the Royal Commission on the South Saskatchewan River Project on Behalf of the Saskatchewan Teachers' Federation

MR. HECTOR G. TROUT

Members of the Royal Commission:

The Saskatchewan Teachers' Federation is happy and proud to have this opportunity of supporting the very fine presentations which have been made so far today in favour of the South Saskatchewan Dam Project. The Saskatchewan Teachers' Federation is a professional organization comprised of all teachers employed in schools organized under the School Act, the Secondary School Act and the Vocational School Act, and has a membership of approximately seventy-two hundred teachers in all parts of the Province of Saskatchewan. As a professional group, we must be

very cognizant of and interested in any movement which affects the economic and general welfare of the people.

With the development of power farming, our farm units are becoming much larger and there is a growing tendency towards urban living. This has created a very serious problem for school administrators and has given rise to a large number of schools with very small enrolment, which we consider to be neither economically nor educationally sound. However, we are concerned not only with the economic and educational problem which this migration to urban living creates, but with the effect of this trend upon the boys and girls to-day growing to manhood and womanhood.

This lack of direct contact with the farm seems to us to detract from farming as a family project. We fear we are developing to-day a group of people who merely look upon farm life as a new industry, a highly commercialized enterprise, rather than a way of life. If the agricultural element of our citizens should lose the love of the soil and the intimate concern with farm life, it would have serious consequences for our whole society. That stabilizing influence which a sound agrarian group has given in the past to society would be lacking. This would have a very serious effect upon the moral courage of our people. We are, therefore, keenly interested in a scheme such as the South Saskatchewan River project that will create smaller farming units and keep our people more closely associated with the art of farming. A stabilizing group of citizenry is badly needed in this very unstable world.

As an educational group we must be concerned with the opportunities for the graduates of our schools. Our study of irrigation areas indicates a diversification of not only agricultural occupations, but other industries. While we have watched with interest and appreciation the slight industrialization of our province, and the present prospects of oil development, yet the main industry of this province is, and we hope will remain that of agriculture.

We are perturbed at the lack of opportunities for younger folk in both industry and the field of farming. With the establishment of larger farm units, it has become almost impossible for any young person without considerable means to become established in farming. We would hope that a wide-scale irrigation project, with its consequent smaller farming units, would not only diversify our agricultural economy, but would make it possible for more and more of our younger people to become established in the industry of agriculture.

The Saskatchewan Teachers' Federation realizes the very close relation that exists between the income of

the farmer of Saskatchewan and the welfare of the teaching profession. The present leaders of the profession are in an age group that was teaching in Saskatchewan in the 1930's, and have very vivid recollections to the effect on themselves and on the profession of consecutive crop failure.

The crop failure and economic depression of the thirties resulted in unprecedented low salaries. Many teachers were contracted to teach for the government grant which, in many cases, was as low as \$200.00 per annum; others had to supplement what small amounts of money they received from school districts by relief orders; such emergency means as boarding around and promissory notes in lieu of salary were quite common; lack of money for books and for attendance at summer schools made professional development difficult. We have dwelt on these conditions of the thirties to emphasize our dependence upon a sound agricultural economy, and why we must be interested in this movement which will bring to this province a more stable economy.

We are interested in this matter not only from a standpoint of our own welfare, but from the effect which recurring depressions have on the public, which are, after all, our first concern. Those of us who taught in the thirties are only too vividly aware of the malnutrition, lack of medical and dental services that was the lot of many of our pupils in those lamentable years. We realize that the situation in the thirties was created by both an economic depression and a series of drought years. While the building of this project may not affect a world wide depression, its completion will do something about the drought years. We would, indeed, be very much to blame if, in more prosperous times, we neglected to provide for the recurring lean years, which would appear to be the lot of this part of the continent. While we must leave the feasibility and the planning of this irrigation project to the experts, we do feel that it is one that will ensure greater agricultural stability for our province, with a resultant benefit to all its people. We feel that it will be of great benefit to our members, whose livelihood depends on the public purse. A project of this kind should be a factor in stabilizing the tax income. We hope that a stabilized economy will permit the payment of adequate salaries and the provision of proper school buildings. This, in turn, will attract and retain in teaching the calibre and quantity of personnel needed. In this province today, we have an estimated twelve to fourteen hundred classrooms with-

out properly qualified teachers. We feel this is a direct result of teaching conditions of the thirties, and while we recognize that as citizens of the province, we must share the fortunes of the other citizens, we also feel that we must urge the implementation of measures that will improve the general economic status of our people.

We are finding a great reluctance on the part of teachers to take schools in the isolated rural areas of this province. The situation has reached a very serious state and we find that trained teachers are turning to other occupations, because they will not go to the rural areas of small population and their lack of modern facilities. It is our opinion that a more densely populated area could be provided under an irrigation system which would be better for teachers and the educational process.

In summary, may we again express our support of this project and join with the other groups and individuals which have spoken today. We feel that this project should be proceeded with immediately. We hold to this premise that

- (a) the completion of this project will do much to retard the urbanization of our rural population;
- (b) the retention of a sound agrarian population is essential to the stability and moral welfare of our country;
- (c) that irrigation will diversify our agricultural occupations and create new industries which will in turn give employment to our young people, and will permit more of our people to become established on the farm;
- (d) it will help stop the draining off of our younger people to industries in other parts of Canada and the world, with a consequent population loss to this part of Canada;
- (e) the completion of this project and a diversification of industry will bring greater stability to our economy.

This in turn will have a salutary effect upon the educational system and the members of our profession, and will make it possible for more adequate educational facilities to be provided, and will attract and retain in teaching in this province a greater supply of teachers.

HECTOR G. TROUT
for
The Saskatchewan Teachers'
Federation.

Submission of the Retail Merchants' Association of Canada (Saskatchewan) Incorporated to the Royal Commission Investigating the Proposed Dam and Irrigation Project on the South Saskatchewan River Near Outlook

MR. C. F. R. WENTZ

Mr. Chairman and Gentlemen:

We, the Retail Merchants' Association of Canada (Saskatchewan) Incorporated, representing retail merchants throughout the Province of Saskatchewan, make this submission to you believing that it is in the best interests of not only the citizens in the irrigable area but to the citizens of the Province of Saskatchewan that this project be proceeded with without delay.

It is an established fact that the population of the Province of Saskatchewan has been declining steadily for a number of years. This was borne out by the latest Dominion census in 1951 and since the Commission is fully aware of this fact we do not propose to elaborate further with population figures for the Province over the past ten, twenty or thirty years. This decrease of population in the Province of Saskatchewan is of great concern to the retail merchant, for, as population diminishes, then so does the volume of business of the retail merchant decrease in proportion. Consequently, as volume of business decreases, the number of retail outlets drops, putting retailers out of business and taking away his means of livelihood. This condition is particularly evident in the irrigable area of the project under review. Any area, whether it be in this Province or in another country, can only support retail outlets in proportion to its population, and the area with the larger population warrants more retail outlets, giving, in turn, greater variety and service to the citizens of that area. It is our belief that if the project is carried out then the trend will be for the population of the Province, as a whole, and the irrigable area, in particular, to show a steady and maintained increase with a resulting increase in the volume of business for the retail merchant in the area, and the opening of additional retail outlets, giving greater service to the community. This is, of course, not only a benefit to the retail merchant, through increase in sales, but also a benefit to the citizens in the area, in turn resulting in benefits to those in neighbouring areas since prosperity is contagious.

The periodic droughts have hit the Outlook—Saskatoon area as severely as anywhere on the prairies, resulting in low average crop yields and consequently, since agricultural stability and security are of prime importance everywhere in Saskatchewan, low gross incomes for all classes of the population. This means

that an area which was once closely settled with all necessary services is now sparsely settled with a reduction in these services, since farmers in this area need to farm more land dry farming than a farmer on land which is irrigated and producing a far larger yield per acre. In view of the fact that each farmer would not need to work as much land in order to get a fair return for his labour, it is our opinion that irrigation of this area would mean a return of farmers, along with a large increase in new settlers, making it once again closely settled, giving the area for all classes of the community better living conditions and higher gross incomes. The resulting improvements in living conditions would be not only social and financial but also include better educational, hospital and medical services with increasing tax revenues to the municipalities, providing for properly maintained roads and other essential services. New immigrants arriving from Europe, who have a desire for agricultural life, along with young Canadians who have the same desire, would have the opportunity and inducement to put their talents to the fullest possible advantage to themselves and their fellow man. With the scarcity of food being one of the major problems in the world today every feasible irrigation project should be fully exploited from not only a personal, Provincial or Dominion standpoint, but also from a humanitarian point of view.

Development of irrigated areas in Alberta, and on a small scale in southwestern Saskatchewan, have proved that a project of this nature can, with sound planning, elevate social, cultural and economical life in the area. The investigations made by the officials of the P.F.R.A., who surveyed and planned this project, have been endorsed by eminent authorities in the engineering, irrigation farming, hydro-electric and other fields as being sound and workable. There is no reason whatsoever then to suppose that what has been proven in similar undertakings in other areas cannot become a reality here. It is our belief that the project when put into effect will bring the same improvements to this area as similar projects have to other areas.

As an auxiliary to the main purpose of the project, namely irrigation, the dam has power possibilities of considerable importance. It has been estimated that hydro-power generation on the project offers great savings over alternative forms of generation which in itself is strong justification for support of the project. The provision of relatively cheap power could contribute greatly to the economy of the Province.

The project will also mean the restoration of lakes both large and small, within the irrigable and adjoining areas, to levels of the better years. This will provide the citizens of this Province, especially those in the

southern part of the Province, with recreational centres and opportunities within easier access of their homes. In turn it will also give the Province the opportunity to develop these outlets for the holidaymaker so as to provide the tourist from the other Provinces and the United States with the inducement to spend more time in this Province resulting in greater prosperity through more money staying in Saskatchewan.

In making this presentation we realize that all aspects of the project have been fully covered by other briefs and submissions, and we ask you to accept this as an endorsement of the investigations and opinions expressed by the surveyors and planners of the project, namely P.F.R.A., and we consider that this scheme not be judged from a short term viewpoint but rather in the light of its long term value to the community, province and the nation. We, therefore, urge you to recommend that this project be accepted and that construction be proceeded with without delay in order that the benefits to be derived from it are available to all as early as possible.

Respectfully submitted,

RETAIL MERCHANTS'
ASSOCIATION OF CANADA
(SASKATCHEWAN) INCORPORATED.

H. R. STACEY,
*Saskatoon Local President and
Past Provincial President.*

C. F. R. WENTZ,
Member of the R.M.A.

Saskatoon, Saskatchewan,
September 12, 1952.

Brief Presented by the Saskatoon Construction Association Affiliated with the Canadian Construction Association of Saskatoon, Sask.

MR. CHARLES A. WHEATON

September 11, 1952.

Mr. Chairman and Members of the Royal Commission:

I represent the Saskatoon Construction Association and am presenting this statement in support of the Saskatoon Board of Trade Brief. The Saskatoon Construction Association has in its membership the General Contractors, Plumbing, Heating, Electrical and roofing and Sheet Metal Contractors, the lumber dealers and all the suppliers of building material together with the Road Builders and suppliers of road and construction machinery.

We would like to impress upon you the necessity of carrying out the dam irrigation project at Outlook for the following reasons:

1. To stabilize the economy of this Province and in turn Canada as a whole by making us not wholly dependent on the whims of the weather.

2. By permitting diversification of crops so that the country can sustain a greater population.

The members of our association will remember thirties when nothing moved but the dust. The dry years produced no crops and the construction industry ceased to exist. Our members have millions of dollars invested in buildings and equipment and an irrigation scheme would protect this investment.

The Construction Association feel that the people of Saskatchewan suffer from a lack of numbers. Community living does not exist. Only the irrigation project would permit a more dense population and hence a more pleasant life.

In view of the above we urge that your report be favorable and that the Outlook Dam and Irrigation Project be commenced without further delay.

Yours Truly,

SASKATOON CONSTRUCTION
ASSOCIATION,

C. A. WHEATON,
President.

Submission of the Labour Progressive Party to the Royal Commission on the Proposed South Saskatchewan River Project

MR. W. BEREZOWSKY

On behalf of the organization which I represent, I urge your Commission to give consideration to, and to recommend to the Federal Government, the following:

- (a) The urgent need to begin the South Saskatchewan project in 1953 and to reduce the time objective for its completion from 10 to 6 years.
- (b) To establish a Saskatchewan River authority to administer this project and to plan additional projects related to the conservation of water from the Rocky Mountains with the view to developing additional areas of irrigation and power throughout the entire water system of the west, including Qu'Appelle and Fort a La Corne.
- (c) That the South Saskatchewan River project be considered as a major national peace project having as its objective the greater economic security and social, cultural well being of the

people of Saskatchewan and the entire country as a whole. The first step towards this should be to devote public funds and energy towards constructions designed not for dealing out death and destruction, but designed to give life, to bring food to the people of the world and the hand of friendship where there is unnatural and artificial animosity.

Build the Dam Now

1. The most outstanding feature in regards to the South Saskatchewan River project is the outspoken support and insistence of people from every walk of life that this development begin without delay. We are confident, fellow Canadians will be proud of our resolution and will support this project, seeing in it a powerful link in the chain of independent Canadian economic, social and cultural development.

For 35 years the people of Saskatchewan and particularly those in the most arid regions, have envisioned in the Saskatchewan River the possibilities of satisfying the aggravated need for water to farm the dry and blowing soils. Engulfed in a heart-breaking battle to live, frustrated in their social and cultural advancement, they have in all these years maintained that vision and fought for it. And that vision and demand have grown. Within the scheme we can see the practical, tangible possibility of power production, flood control, Municipal water supply and tremendous new fields in recreational facilities.

The investigations, surveys and planning endorsed by eminent independent authorities and conducted by competent engineers, geologists and economists bear out and give strength to the demands of the Saskatchewan people that the project begin now. It is practical, economical, feasible and necessary. The project is too urgent, too vital to the peoples' needs to be treated as a political football, a matter of election promises and partisan advantage.

2. Our country is extremely wealthy, first in its people and in the extent of its natural resources. We possess all the manpower required to do the job (over 200,000 unemployed—*Labour Gazette*—August 1952) and we have demonstrated on more than one occasion our engineering skill and technical knowledge. Within our own borders we have an abundance of iron and non-ferrous metals and certainly the capital to finance it. Our national budget surpluses could pay the estimated requirements twice over.

3. The greatest natural hazard throughout the entire Prairies and recognized by all, is the continuous and in all too many cases a losing battle to conserve the precious soil moisture. Particularly is this true in

the development area. Our history over the decades indicates definite possibilities of disastrous droughts, so that over a 10-year period resources which should go to rectify the conditions would needs be allocated to the results of the condition.

Our past experiences, particularly during the second world war, proved our ability to undertake immense national and international projects. In consequence we can hasten the period required to build the project from 10 years to at least six. There is every reason for confidence in the ability of Canadian engineers and technicians to revise their plans and carry them out, given the green light by the Federal Government.

4. An immediate start in the work would have the effect of stemming our depopulation, giving our young people, particularly, a firmer perspective in a real developing future. We have already lost heavily in the emigration of many of our best engineers, technicians, etc., due to our backwardness in developing essential irrigation and power schemes.

5. Because of new discoveries of oil, uranium and other valuable minerals in Saskatchewan the opportunity of building industry in this Province and adding new wealth to our country is greatly enhanced. Within this development can be seen an opportunity to accomplish this, preventing our natural resources being drained off to American industry by using the excuse that our Province suffers prolonged drought and an uncertain economy, that we lack power, that our population is diminishing. The Saskatchewan River Project as projected in the mass of data assembled, will prevent the depopulation of Saskatchewan, the spoliation of the soil and the uncertainties of our economy. The people of Saskatchewan can never again tolerate the "Hungry Thirties."

Saskatchewan River Authority

The South Saskatchewan River project cannot be separated from the whole development of our western water system from the Rockies to Ontario. The vital problem of solving inadequate moisture conditions throughout the western Prairie provinces is one of the most serious. That Canada trails in irrigation developments is proved by the advanced stages of irrigation in many countries of the world. For instance, while Canada has only 950,000 acres under irrigation, the Argentine has 3,200,000 and Australia, a country economically less advanced than Canada, has a million acres under irrigation with a proposed development of 11 million additional acres. France irrigates 3,150,000 acres, Iran 2,500,000, China 90 millions and the Soviet Union 8 million, with both the latter countries launching tremendous conservation and irrigation

schemes involving tens of millions of acres. There is a need for a Saskatchewan River Authority empowered to plan and initiate a series of projects in the three Prairie Provinces designed to greatly increase land productivity, productive land areas and power resources.

Build for Peace

Out of the Saskatchewan River Project and certainly out of an entire reorganization of our western economy, through the efficient use of our resources, must arise a more stable agriculture, new sources of electric power, development of various industries and a greater volume of trade and commerce. To our people this will mean more security for our farmers, jobs for our workers and a real place in Canada for our youth, assuring our welfare, social and cultural progress. Is not the welfare of a people the real strength of a nation?

In the world in which we live—divided, launched once more on an armaments race—will not such gigantic construction developments strike at the very roots of the immense danger of war? If the slogan accepted by agriculture and industry in the Second World War, "Produce for War", made a profound contribution to the winning of the war, how much more effective would the slogan "Produce and Build for Peace", be to the maintenance of world peace. This is most forcefully emphasized by the fact that the cost of the entire South Saskatchewan River project is no greater than the cost of 100 jet fighters whose destruction could be effected in one week.

Conclusion

The South Saskatchewan project is urgently required. Its benefits are immense. We possess the plans for its construction: the engineers for its direction, the people to do the job and the materials from which to build. May I again urge the Royal Commission—to recommend to the Federal Government that it act—to begin in 1953 the building of a dam at Coteau and related construction as set forth in the report of the P.F.R.A. engineers; that, to administer the project, a Saskatchewan River Authority be established which shall include representatives of the farm and labour unions of the three provinces and that this Authority also be empowered to plan and execute projects with a view to developing irrigation and power involving the entire water system of the prairie region.

All of which is respectfully submitted by

THE PROVINCIAL COMMITTEE,
LABOUR PROGRESSIVE PARTY

Saskatoon, Sask.

September 12, 1952.

Political Aspects of the Proposed South Saskatchewan River Project

MR. OLAF TURNBULL

Introduction.

In considering the multi-faceted and lengthily debated South Saskatchewan River Project, some consideration must be given to the political aspects involved. I do not use the word with any malice prepense, but will attempt to make an honest analysis of the practical political issues involved regardless of the party forming the government. I want to make it perfectly clear that I am not aiming at any particular political party or at any individual or groups of individuals in the provincial or federal arenas. I will try to assess some of the points that undoubtedly would be considered by any government faced with making the decision of whether or not to build the proposed dam and develop the area involved.

The Short Run Political Problem (Federal)

The main short run aspects are the following:

1. The distribution of population and corresponding number of members representing the area directly involved.
2. The distribution of population and corresponding number of members representing areas indirectly involved.
3. The particular party the above members represent.
4. The political complications arising from differences of interest between areas, and alternative public expenditure between these areas.
5. The dilemma of the possible loss of seats in either area as a result of a decision.
6. The aggravation involved if the majority of seats in any one area is held by the opposition, particularly in the directly involved area.
7. The possibility of weakening the government's position so that the balance of power might fall into the hands of a third party.
8. The use of the proposed project as ammunition for election campaigns.

In considering these points it would be well to bear in mind the axiom that radical political thinking is closely linked with any area of spasmodic and irregular productivity. An area under irrigation is the complete antithesis of radicalism and the desire for immediate and complete change. The constant productivity, the long range planning and the assurance of stability would immediately be reflected in the political thinking of such an area. Any government responsible for

such development would strengthen their position immeasurably in the districts directly and indirectly involved. A further strengthening would result in the increase in the number of seats as a result of increasing populations. The fact that the people came to the area to accept the tangible results of a government's policy would indicate that they would support it politically.

Even though the area were represented by a member of a party not forming the federal government, no embarrassment would occur to the party in power. By embarking on the program it would steal the opposition's thunder and leave them without much ammunition on this one point. The sooner the project is started the stronger the government's position. Conversely,—it is weakened by delays.

Points (4), (5) and to an extent (8) fall under the general issue of alternative expenditure. Again I submit that it would be more profitable politically to embark on the project immediately. There may be some short run embarrassing effects from (5) but the long run view far outweighs the short run.

Public Expenditure—The Political Aspects

The idea has gradually evolved that a public works program is highly desirable in order to stabilize the business cycle. Fluctuation in political fortunes coincide closely with fluctuations in the business cycle. A very strategic part in the smooth and successful functioning of the economic system can be accomplished if public works are integrated as an agency of economic stabilization.

In the past public works have been entered into as a relief measure and as result the optimum effect could not be utilized because of improper timing. The dam comes not in a time of depression, but in the very opposite. Without entering into the field of economics, it would appear that our boom period may be near a recession, particularly if the Korean war should cease, so that a start might have the project into a position where it could be used to the optimum during a period of falling prices.

I do feel however, that the political factors above out-weigh the economic arguments that might be advanced, just as they did in the decision to construct the St. Lawrence Seaway. This construction was indicated in these times on the grounds that it is vital in the conflict between the United Nations and the Communistic Bloc.

The construction of the dam on the South Saskatchewan River, and the development of the irrigable area is just as important in this struggle that has been entered into and can only end in one victor. A shooting

war may not be engaged in any larger extent than we now have, but the "cold war" is sure to become more and more intense, both at home and abroad, lasting for many years.

Let us consider this unique aspect of the dam and the political struggle; evaluating it in terms of Canadian politics alone.

The Long Run Political Factors

These are more subtle than the short run, and are dangerous not only to the party in power, but to the Canadian society as a whole. These factors have a sufficiently destructive potential capable of starting the disintegration of our present form of political life in the manner we have observed other democratic nations destroyed. We in Canada have watched this trend with hypnotic fascination, almost as a child is drawn too closely to a fire, this slow but sure disintegration, and the use of Fascism, Nazism and Communism. To those that would shrug it off with "it can't happen here" I should like to say "it is happening here".

I am not a political scientist. There are many, many more qualified than I. But I was bred, born and raised in an area where radical thinking is the rule. My generation has been conceived in a dust bowl, weaned on a depression, and matured in the maw of the monster, WAR. We are questioning the standards and functioning of a society that has stood for generations. We are falling away from our churches, but looking for a faith. Above all we have been very thoroughly instructed by our society that material success alone is the single standard by which a man is measured. He can only qualify for the chromium plated pleasures that are dangled before him if he can buy them. We are building towards an uncertain future, with the desperate knowledge that our wheat economy will ultimately result in our own economic destruction, and the destruction of the land that we farm. The lack of conservation of our land resources is paramount, and grows as land holdings increase. Erosion is inevitable under the summerfallow wheat rotation.

The political parallel between our present times and the latter Roman and Grecian eras is startling. The same concentration of property in the hands of the few, the slow disintegration of religion, the same emphasis on material pleasures, the elimination of the small land holder, the destruction of his economic integrity making him look for assistance either from the state or a strong man or group of men. And finally the destruction of the society and the elimination of the nation. These are continual processes that exist in the lifetime of all nations. They must meet

them successfully if they are to survive. We can do this, as Dr. Wiltso has indicated. We can meet the challenge in part by the erection of the dam, more than by any other public works, seaway included, as the cornerstones of his philosophy are repeated in the individual, the community, the provincial and federal governments. And the faith, knowledge, co-operation and industriousness grow stronger in life, and larger in proportion with each repetition. Canada would invest in herself and reap a harvest a hundred fold.

The development of the irrigable area means that a start in rebuilding a slowly demoralizing society would begin. Technological factors are such that large farms are impossible, the small holding would increase and a healthy farm class would exist in an area where instability is the rule. If a nation is to be steady politically it must have a solid agricultural class.

If every city in Canada were destroyed but a healthy farming stock existed, the nation could be rebuilt. But let the land and farmers become impoverished and diseased, and the cities will wither away and the society will disappear, for the land and those that till the land are the backbone of the nation.

I believe Mr. Chairman, that your commission was impressed by the calibre of the Canadian citizen you met at Outlook, Saskatchewan. I do not believe a greater bulwark for democracy exists anywhere in the world. Their integrity, their open-faced honesty, and their ability to stick, and stick, in spite of such adversity impresses us all. It was a thrill to see how they still retained their humor even after 35 years of grappling with a problem as immense and almost as immovable as a mountain. I was reminded of a smug city man, visiting a similar area, watching an old and gnarled farmer working his stubborn soil, who couldn't resist asking "What do you expect to grow here?" The old man paused a minute, and spat on the ground, then squelched him with a single word—"men".

They raise men in that area, but they cannot continue to battle alone. Every time one looses his grip and falls to the never-relenting natural forces, all of Canada looses, the drugs of discontent are strengthened, and the pillars upon which our society is built are eroded a little more. And the rest watch the drowning in a sink and wonder—"will I be next?"

Couple that situation, the dream of irrigation and all it means, and you have a highly explosive social mixture. Every delay in development results in a little more cynicism. Like dropping a pebble into a pool, with ripples going out from the source, bounding off the edges and recrossing in ever-increasing complexity. So these delays and doubts that strike the

one sustaining hope of a better life disturb the minds of these men. A person can only stand so much. Perhaps a different society would be the answer.

Canada cannot stand for such a dangerous situation. Disillusioned men, frustrated youth, migrating to the cities, competing for jobs; men that know the soil, love the soil and the feel of the soil, forced onto cement and punching a time clock. These are the flotsam and jetsam of a wheat economy, striving to do the ridiculous and impossible. These are the men that rightfully question and ridicule a society that apparently rejected its obligations. These are the men that long for the strong state that they are told can do all they ask. These are the ones who fall prey to the communistic philosophy of a better existence.

No political party would willingly retain such a cancer in Canada. No society willingly turned on itself and destroyed the heritage of freedom that has taken generations of brave men to build. For freedom is the supreme good, without it personality is impossible.

We have watched these nations go down. And as we watch, let us turn our gaze inwardly and we will see the same economic demons being fostered. The building of this dam, the development of the area, the repopulating of this semi-arid land by a people flushed with hope and faith in themselves, the soil, the water and their society that made it possible is as solid a blow to the forces that exist to destroy free men, as any other in the whole of the Dominion.

What an envious position you men on the commission hold. To be able to do so much for a land and nation you love, as we do.

Can you imagine the jubilation if you bring down a decision recommending the immediate start on the project? What a drama would begin to unfold. What a building and planning. If by your decision the dam is built you are not only watering the parched soil; you are not only clothing a naked land and making a friendly area out of a hostile one. Far greater than that, you are building a greater Canada watering men's souls with the knowledge that by their way of life they have been able to create for themselves and all of Canada much that never existed before. You will strike as great a blow in Canada for our democratic way of life than any other.

Conclusion

As Dr. Widtsoe said—the building of the dam is inevitable. The only thing to be decided is when. Even if you men do decide to recommend immediate construction the spectre of political expediency hangs over your labours. Your report could be shelved, or put in a pigeon hole already reserved for it. In attempting to present the political aspects of the

project I hope I have given you yet another reason why you will be able to convince the government that an immediate start on the project is urgent. The short run political factors would seem to indicate that it is expedient to start construction. Consideration of the long run factors would indicate that delays are extremely dangerous.

I do not mean to imply that if the dam is not built all of Saskatchewan will become communistic. The solution is not as simple as that. But I do insist that if our society cannot accept the challenges that are thrown upon it, if it will allow the existence of a depressed area to continue, when it is possible to make it one of the greatest cornerstones of stability instead of a political bomb that would continue to spread discontent and disillusioned people all over Canada, then it will surely decline, until the people will revoke it here as has been done elsewhere in the world today.

Respectfully submitted.

O. TURNBULL,

S.F.U. Director District 11

Endorsed by Saskatchewan Farmers Union.

Submission by Canadian Association of Consumers

402 Owen Street,
Saskatoon, Sask.,
Sept. 11, 1952.

The Royal Commission on the
South Saskatchewan River Development.
Gentlemen:

Executive members of the Saskatchewan Branch of the Canadian Association of Consumers strongly endorse the overall proposals for construction of the dam and irrigation project. The problems of the area requiring solution, and the benefits that would accrue, have been dealt with at length during the hearings by your Commission. This Association is convinced that the economic betterment of the large area directly concerned will extend to the Province, and in fact, to Canada as a whole.

The large land area capable of irrigation has cost our Provincial and Federal Governments millions of dollars over the past 20 years to assist an extremely hazardous agriculture. Southern Alberta provides the evidence of what water, of which an unlimited quantity is available, will do to transform such a condition. The Saskatchewan Branch of the C.A.C. therefore endorses all those submissions that urge an immediate commencement of the project.

Yours very truly,

(Sgd.) Jean L. Suggitt,

for Mrs. Neil Morris,

Corresponding Secretary,
Saskatchewan Branch C.A.C.

PROVINCE OF MANITOBA

Province of Manitoba, Office of the Premier
Winnipeg

April 29, 1952

Dr. T. H. Hogg, Chairman,
Royal Commission on the South
Saskatchewan River Development,
406 Elgin Building,
Ottawa, Canada.

Dear Dr. Hogg:

I was glad indeed to learn from Mr. Richardson's letter that you have fully recovered from your recent illness and that you propose being in Winnipeg on Friday, May 9th. Needless to say Mr. McDiarmid and I will be pleased to have a discussion with you.

I had not previously placed before you Manitoba views in connection with your Commission's inquiry because of your illness, but think I might do so briefly now so that you will have a general knowledge of them when we meet for discussion on May 9th.

Manitoba has welcomed the appointment of your Commission as a body which can deal thoroughly and impartially with the questions referred to it and make findings and recommendations which will be of great value to all interested governments and individuals.

I believe that there is already available to our Commission the result of extensive engineering studies and investigations relating to this project and I assume that in accordance with the terms of reference set out in P.C. 4435 your Commission will give immediate and serious study to these data, plus of course any further investigations you deem advisable, to ascertain whether the project is economically feasible. I feel also that your Commission should obtain the opinion of engineers and expert consultants as to what adverse effects this project might have upon Manitoba's resources. As you will appreciate, Manitoba's share of the Saskatchewan River is the residue remaining after approved appropriations are made effective in other provinces. It is quite possible that this project could cause a serious decline in the potential capacity of the power sites on the Dauphin and Nelson Rivers. These power projects are substantial undertakings which must have dependable flows of water assured if they are to be successful. It

would appear therefore that your Commission should give consideration at this time as to what responsibility the Government of Canada should accept for the integrated development of the entire watershed.

It is noted that according to P.C. 4435 your Commission is directed to consider not only the engineering and technical possibilities of the South Saskatchewan project but

"Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;"

and

"Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved."

While it is not a usual function of the Manitoba Government to advise on financial policies of the Federal Government, we suggest that when you are assessing "Whether the economic . . . returns to the Canadian people on the investment in the proposed South Saskatchewan River Project . . . would be commensurate with the cost thereof" you give consideration to the fact that if Federal taxpayers' money is to be used to build or assist in building a hydro-electric power development in the Province of Saskatchewan, Manitoba people will be justified in asking that similar assistance be extended to us in developing the sites above mentioned to supply the electrical power that will soon be needed in this province.

I trust this brief introduction to Manitoba's views on this question will indicate to you the importance we attach to the work of your Commission and some of the problems which we feel should be considered at this stage of your investigations.

I shall be looking forward to meeting you on May 9th.

Yours very truly,

(Sgd.) DOUGLAS CAMPBELL.

The Saskatchewan River and Manitoba's Problem

D. M. STEPHENS, M.E.I.C.

(Published in *Engineering Journal*—June 3, 1948)

The main elements of Manitoba's Water Problem can be briefly stated.

In the first place, Manitoba is a sub-humid region. The Province lies in a low rainfall area where the annual precipitation ranges from 14 to 22 inches. Except for the occasional spring freshet when local flooding might occur, we are likely to be chronically short of water. That is the first element of our problem.

The second element of Manitoba's water problem is to be found in the fact that we lie at the bottom of a whole series of drainage basins, the water courses of which rise in and flow through other jurisdictions. Many of these water courses flow through provinces or states which also suffer from chronic shortages of water; and in some of these the shortages might be more acute than those suffered by Manitoba.

These conditions which exist in jurisdictions outside of Manitoba have given rise in the past and will no doubt continue to give rise to watershed developments and water uses which have had and will have an adverse effect upon Manitoba's water supply position. It will be obvious, of course, that to whatever extent water is extracted from streams flowing into Manitoba and is dissipated for irrigation or other similar purposes, Manitoba's chronically mad water supply situation will be, to that extent, worsened.

The third element of our water problem relates to the nature of our terrain. Manitoba is a region of relatively low relief. Surface elevations vary from a maximum of 2,724 feet above sea level datum in the Duck Mountains to sea level along the shores of Hudson Bay. Lake Winnipeg, an immense collecting basin for the very large watersheds draining into Manitoba lies at elevation 713 feet above sea level. The mean level of the Winnipeg River at the Manitoba-Ontario Boundary is approximately 982. The main level of the Red River at the International Boundary is 750. The Souris River enters Manitoba from North Dakota at elevation 1,402. The Assiniboine River enters from Saskatchewan at elevation 1,375, and the level of the Saskatchewan River at the Manitoba-Saskatchewan Boundary is approximately 855. With respect to water matters, Manitoba's relatively flat terrain imposes certain definite limitations upon us. Above Lake Winnipeg and with the exception of the Winnipeg and Churchill Rivers, there is very little natural storage on any of our streams. This means relatively poor natural regulation and a very uneven stream regimen with flows varying through wide extremes from season to season and from year to year. A second limitation which is imposed upon us by

the nature of our terrain is that there is exceedingly little scope within Manitoba for the creation of large storage reservoirs for the control of river flows. This applies particularly to the Red River, the Souris River, the lower reaches of the Assiniboine River as well as the Saskatchewan River above Cedar Lake.

The limitations which are imposed upon us in the matter of water storage are particularly serious when considered in relation to the uneven regimen of our prairie rivers, such as the Red and the Assiniboine. It is with respect to these streams that we are likely to suffer extreme water shortages during certain periods. It is in these same watersheds that we are faced with most acute flood hazards. It is also on these watersheds that the nature of our terrain imposes the most severe limitations in the matter of water storage.

With respect to the portion of the Red River which lies within Manitoba, for example, it would be physically impossible to create sufficient storage to provide what might be called adequate river regulation. On the Assiniboine River we would have some scope for the development of storage in the deeper portions of the valley in the extreme western portions of Manitoba.

Other and closely related limitations are imposed upon us by the nature of the Manitoba terrain. There are few places, for example, where large dams could be built for irrigation purposes and which would make it possible to command any substantial acreage by gravity. The relatively flat gradients which characterize our prairie streams when considered in relation to the uneven stream regimen and the relative lack of storage possibilities means, of course, that the prairie streams are not well adapted to water power purposes.

The fourth element of Manitoba's water problem becomes apparent when we examine water in relation to other resources. Here I would like to refer specifically to energy sources. There are at the present time no large known sources of coal, oil or natural gas in Manitoba. The water power resources, therefore, constitute our main known energy source and energy reserve. Any commodity which aspires toward an industrial future and which has, so to speak most, if not all of its energy eggs in one basket would be wise to watch that basket very carefully. It is for this reason that the people of Manitoba place a good deal of emphasis upon water power matters and that water power management takes a rather high place in our thinking and planning.

There is another point which I should mention and which relates to the very great interest which Manitoba takes and is likely to continue to take in water power matters. Of the 246,512 square miles contained within the Province of Manitoba, only 16 per

cent is agricultural land. In a very large proportion of the remainder we must look to forestry and mining to provide the main economic activities of the future. The forest are of such a type as to lend themselves more readily to pulp, paper and cellulose products than to lumber. There are very encouraging indications at the moment that in our northern areas and in the relatively near future we may see some very large mining developments, particularly with respect to base metals. The point that I wish to bring out now is that the pulp, paper, cellulose and base metal industries are almost as dependent upon cheap power as they are upon the wood and ores that make up the raw materials. Without Island Falls on the Churchill River or some other water power site which would be equivalent in terms of capacity and costs, the Flin Flon mine which now supports a city of 10,000 people would never have been developed. It takes almost 100,000 h.p. to keep Flin Flon going and there are other large known deposits of ore in the immediate vicinity of Flin Flon for the treatment of which still more power will be required. Without the water powers on the Winnipeg River there would be no paper industry at Pine Falls in Manitoba. It takes almost 35,000 h.p. to support this community of approximately 1,100 people and to provide an economic use for 2,000 square miles of bush land. The lack of cheap power in either of these instances would have resulted in the wastage of resources which otherwise could be and indeed have been enormously productive.

It is against this background that we must examine Manitoba's interest in and concern about the Saskatchewan River.

I think it would be safe to say that the co-ordinated development of the water and related resources of the Saskatchewan River watershed represents one of the most important and one of the most complex problems in the field of resources management with which Canada is faced to-day.

There are two national governments, three provincial governments, one state government and literally hundreds of municipal governments, each having its own general or special interest in the Saskatchewan River.

There are at least six separate and distinct geographic regions each with its separate and distinct problems and possibilities relating to the control and use of water, not all of which are by any means compatible with all others.

First there is the mountain and foothills area where forest protection, power and storage will probably remain the dominant problems respecting the Saskatchewan River.

Next there are the south-western prairie regions characterized by relatively steep river gradients, semi-arid climate, high summer temperatures, long growing seasons and, not the least important, populated by experienced irrigation farmers. These characteristics have been particularly favourable to irrigation. The steep slopes have made it possible, with a single dam and with a minimum of flooding damage, to command the maximum acreage solely by gravity. The climate has been favourable to irrigation not only because of the high summer temperatures and long growing seasons, but also because of the low precipitation which makes irrigation an *annual* necessity for the wide variety of cultivated crops grown in these localities. The steep river gradients which make it possible to command large land areas at relatively little cost also provide favourable conditions for the generation of hydro electric energy.

Then comes the central prairie portion of the Saskatchewan River watershed. Through this region the Saskatchewan and its tributaries flow through relatively deep valleys, usually several hundred feet below the general prairie level and the river gradients are relatively flat. As the river flows easterly it passes through areas that have somewhat lower summer temperatures, higher annual precipitation and where dry land farming is relatively less hazardous and where very great difficulties would be encountered in using water either for irrigation or for power purposes.

Between the prairie regions and Cedar Lake just above Lake Winnipeg, the river flows through a broad flat valley which is generally lightly wooded but which is dotted with numerous shallow lakes and large open marshes. Throughout the eastern portion of this broad flat valley and for many years the main economic return has been from aquatic fur bearing animals which thrive in the immense marsh areas wherein the water is periodically replenished as the Saskatchewan River overflows its low banks. Much of the eastern portion of this area is a flood plain or delta formation built up through the deposition of silt. During recent years two very interesting experiments have been going forward simultaneously in those portions of the Saskatchewan River delta or flood plain which lie between the Saskatchewan-Manitoba boundary and Cedar Lake.

From 1936 up to the present time the Province of Manitoba in co-operation with other agencies, including the Dominion Government and Ducks Unlimited (Canada) has carried out a large program of engineering work to permit the close control of water levels in the large areas of the Saskatchewan River delta. The primary purpose of this work was to increase and stabilize the muskrat crop upon which approximately one

thousand Indian and halfbreed families have depended for a major source of their livelihood. Since 1940, when these areas first came into production, muskrat pelts to a value of \$2,914,125.00 have been harvested from these marsh areas and \$1,872,985.00 have been distributed either in monthly payments or supplies issued to trappers.

The second experiment which has been going forward simultaneously with muskrat rehabilitation in this region is with respect to agriculture. During recent years increasing use has been made of the rich soils of the delta for agricultural purposes. Along the higher lands of the lower Carrot River valley new areas are being brought under cultivation each year and there is now a thriving dairying and farming community just west of The Pas.

These two uses of the Saskatchewan delta, namely, muskrat ranching on the one hand and agriculture on the other, are not altogether compatible. For successful muskrat ranching the periodic peak flows of the Saskatchewan River are an essential requirement, since it is only under these conditions that we can be sure of adequate water for marsh purposes. From the standpoint of successful agriculture these same periodic peak flows, particularly July and August peaks which are caused by the mountain water, hold out a constant threat of flooding and constitute the primary hazard.

The large lake basins of Manitoba might be considered as the fifth natural geographic region of the Saskatchewan-Nelson system. Lake Winnipeg, with an area of approximately 9,400 square miles is the main lake of this region. This is the central collecting basin for the entire upper Nelson System. Lake Winnipegosis, with an area of 2,086 square miles, and Lake Manitoba, with an area of 1,817 square miles, lie parallel to and immediately west of Lake Winnipeg. Lake Winnipegosis, the upper of these two lakes, lies at approximately the same elevation as Cedar Lake on the Saskatchewan River and is separated from that lake by an isthmus which is four miles across at its narrowest point. By excavating a canal across this isthmus, by constructing a control dam at the outlet of Cedar Lake, and by channel enlargements between Lake Winnipegosis and Lake Manitoba as well as between Lake Manitoba and Lake Winnipeg it would be possible to divert the main flow of the Saskatchewan River through the course which I have described and to concentrate a head of approximately 90 feet at a single site between Lake Manitoba and Lake Winnipeg. The immense storage which would thus be afforded by Lakes Winnipegosis and Manitoba would be particularly advantageous from the standpoint of low load factor power plant. It is partly for this reason that in planning future water

power developments in Manitoba especial consideration is given to the Saskatchewan River diversion and the development of power at what is called the Dauphin River site.

The main lake basins of Manitoba, comprising Lakes Winnipeg, Winnipegosis and Manitoba, are of substantial economic importance to the Province. These lakes are the mainstay of a large and important fishery which keeps Manitoba in either first or second place amongst the Provinces of Canada with respect to the production of freshwater fish. These lakes are important to transportation and navigation and bring large areas of the Province within economic hauling distance for forestry and other purposes. There are foreshore values which are of economic importance. These include summer resorts, hunting and trapping rights as well as haying and ranching areas.

The sixth important geographic region of the Saskatchewan-Nelson system comprises the valley of the Nelson proper, lying between Lake Winnipeg and Hudson Bay. Over this reach the Nelson River falls through slightly over seven hundred feet from Lake Winnipeg to sea level at Hudson Bay. While no accurate long term hydrometric measurements are available, it is estimated that the flow at the outlet of Lake Winnipeg has ranged from a high of approximately 140,000 c.f.s. in 1927 to a low of 28,400 in January, 1941. By adding slightly to the latter figure, out of regard to the improved regulation which could be obtained on Lake Winnipeg and assuming the natural flow of the watershed were available, it would appear as though approximately 2,000,000 h.p. of 24 hr. power could be developed on the Nelson proper. Manitoba now has approximately 600,000 h.p. either developed or under development. The undeveloped water power resources are estimated at approximately 3,500,000 h.p. (ordinary minimum power). It will be seen, therefore, that something between a five-fold and six-fold increase in water power development would completely exhaust our known water power resources. It should be noted in passing that Ontario experienced a five-fold increase in water power development in the fifteen-year period between 1917 and 1931. It should also be noted that the Nelson River represents something over 57 per cent of Manitoba's reserve of undeveloped power. Having regard to the overriding importance of Nelson River power in Manitoba's overall power picture on the one hand, and having regard to the further fact that, other than water powers, we have no important known fuel and energy reserves, Manitoba's concern about what happens to Nelson River power will be readily understood.

It is in the light of these considerations that Manitoba must examine the overall economic effects which would be likely to follow upon large scale water losses from the Saskatchewan River.

In July 1945 Mr. Ben Russell prepared a very excellent paper entitled "The Saskatchewan Drainage Basin, Water Development Possibilities and Problems". In that paper Mr. Russell stated in part as follows:—

"It has been estimated on the basis of gravity diversion that the irrigation requirements of the Saskatchewan River Drainage Basin in Alberta may ultimately be 2,799,000 acre feet and in Saskatchewan 1,228,000 acre feet, or a total of 4,207,000 acre feet or sufficient for 2,539,000 acres. If and when pumping on a large scale is resorted to the limit will be raised considerably....."

In the same paper Mr. Russell estimates that on the basis of the normal year diversions to the extent of 4,207,000 acre feet would represent a 23 per cent reduction in the total flow of the Saskatchewan River at The Pas, Manitoba. In the low water year, which, of course, would be the critical year, these diversions would reduce the flow into Manitoba by approximately 40 per cent.

What are the effects which would follow upon these large diversions in so far as the Province of Manitoba is concerned?

While I am quite prepared to accept Mr. Russell's estimates as to the amount of water which could be used for irrigation in Saskatchewan and Alberta, I am not altogether prepared to accept his appraisal as to the downstream effects of these diversions.

In the report to which I have already referred, Mr. Russell says,—

"There is the problem of water levels in Manitoba . . . When some 4,000,000 acre feet of water is diverted each year in Alberta and Saskatchewan for irrigation, such a diversion is bound to affect the lake levels in Manitoba and therefore protest will undoubtedly be made by that Province. The solution to this is simple and consists of a control structure at the outlet of the lake to the Nelson River and less water wasted to Hudson Bay and therefore more water for the lakes."

It will be noted that in the matter of the deleterious effects which Manitoba would suffer as a result of large scale diversions from the Saskatchewan River, Mr. Russell confines himself to a consideration of the effect upon the levels of Lake Winnipeg. This would not be the total effect nor even the most important one.

We might get a clearer picture of these deleterious effects and the rather profound influence which they

would have upon Manitoba if we consider the various reaches of the Saskatchewan-Nelson system in order—starting at the Saskatchewan-Manitoba border.

I have already mentioned the very successful muskrat rehabilitation work which has been carried out in the marsh lands of the Saskatchewan River delta in the vicinity of The Pas. These projects are regarded as amongst the most advanced and successful marsh management schemes that have ever been attempted. They provide a sound economic use for very large areas of what previously had been waste lands. These projects now supply the major source of income to something between 700 and 1,000 families and have added well over \$3,000,000.00 of new wealth to the Province during the eight or nine years they have been in operation.

Since adequate water supply for these projects depends very largely upon the high summer peak of the Saskatchewan River, and since the western diversion schemes would necessitate the creation of large storage reservoirs and the radical reduction of summer peaks, there is every likelihood that Manitoba's muskrat scheme in the delta area would be an early casualty of the proposed diversion.

I have already mentioned something about water power matters and pointed to the probability that well within the next decade we will be required to develop power from the Saskatchewan-Dauphin scheme and from the Nelson River. It is important, therefore, that we examine the effect which large scale diversion of Saskatchewan River water would have upon our potential water power resources.

The first enlargement of the Saskatchewan River in Manitoba is at Cedar Lake which happens to lie at the same elevation as Lake Winnipegosis, namely, 831 ft. above sea level. A simple calculation will show that at 80 per cent efficiency, the loss of 4,207,000 acre feet per year represents the loss of approximately 440,000 h.p. of 24 hr. power. Depending upon the load factor which is used this would probably represent a loss in potential power installations, probably in the range of 650,000 to 750,000 horse-power. In a region which suffers an acute deficiency with respect to fuel or energy sources, 700,000 horse-power represents a lot of power. For purposes of comparison I should point out that when the present expansion program on the Winnipeg River has been completed the four large plants on that stream will have total installed capacities of something less than 600,000 h.p.

I have referred to Manitoba's potential water power resources as our major, in fact, our only source of low cost energy. Let me translate 440,000 h.p. of 24 hr. power into terms of fuels. For this purpose let us

assume that it would cost \$200.00 per installed horsepower to develop this power. Let us assume further that the annual costs of delivering the power would be, say, 8 per cent of the capital investment.

If 440,000 h.p. of 24 hr. power were to be developed by the use of coal of say the grade of Alberta bituminous, it would require 1,880,000 tons of coal per year.

If this power were to be made available at a cost corresponding with the costs which I have assumed for hydro electric power, it would be necessary that the coal be laid down near the site of Manitoba's power requirements at something slightly under \$1.90 per ton.

If we were to attempt an evaluation of these large energy losses, on the basis of substitute sources of energy in Manitoba, we would arrive at some very interesting figures. On the basis of the assumptions which I have stated it would be necessary for us to use 1,880,000 tons of Alberta bituminous grade coal each year to develop 440,000 h.p. of 24 hr. power from steam plants; also it would be necessary to deliver this coal to Manitoba plants at something under \$1.90 per ton if the costs of energy were to be kept in line with those likely to be experienced in hydro power. But the present cost of Alberta coal, or coal of equivalent grade in Manitoba runs from \$12.00 to \$15.00 per ton. One method of arriving at the cost of substituting steam power for the 440,000 h.p. loss of firm hydro power would be to evaluate the difference between the actual cost of coal and the hypothetical hydro electric equivalent. This would amount to something between \$10.10 and \$13.10 per ton. The annual difference, on the basis of 440,000 h.p. firm would be something between \$19,100,000 and \$24,600,000. In so far as there might be an element of permanency to the situation which we are discussing, figures of hypothetical annual losses fail to give a clear picture. For this purpose it would be necessary to capitalize the annual figures to which I have referred. If this were done at say 3 per cent, it would produce figures in the neighbourhood of \$500,000,000 to \$800,000,000.

I do not suggest that this is an adequate method for placing a dollar value upon potential water power resources nor upon the damage which would result from their diminution or loss. This method simply indicates the offsetting amounts which would be necessary if we were to attempt to produce equivalent amounts of power at equivalent costs. It does not take into account the economic loss which would be suffered by the nation, or a province, or a region if, through lack of power we were unable to develop our forest or base metal resources. It does not take account of the marginal nature of some water power sites, where a potential development may be an economic undertaking

under certain conditions of river flow, but may become a wholly uneconomic undertaking under radically different conditions of flow.

In this latter connection I might mention the power project which we refer to as the Dauphin River scheme. In this case and with the natural flow of the Saskatchewan River available it is estimated that up to 250,000 h.p. could be installed at the Dauphin River site. The costs would be relatively high but the probabilities are that it would be an economic undertaking if the full natural flow of the Saskatchewan River were available. If during the critical or low water year, however, the Saskatchewan River flows were reduced to say 60 per cent of the natural low water flows, the result might be to reduce the potential installation from 250,000 h.p. to 150,000 h.p. Having regard to the fact that a major portion of the costs of this project would be represented by canals, diversion dams and channel improvements, and that the costs of these would be roughly the same for 150,000 h.p. as for 250,000 h.p., it will be seen that a drastic reduction of flow in the low water year might very easily change the Dauphin River scheme from an economic to an uneconomic undertaking.

From the fuel or energy standpoint, Manitoba's concern about large scale diversions of water from the Saskatchewan River will be readily understood if we keep the following points clearly in mind.

1. Manitoba has no important known reserves of coal, petroleum or natural gas. Our water power resources, therefore, constitute our only known energy source or energy reserve.
2. In relation to probable industrial demands for power and in relation to the nature of our other resources, such as forests and base metal deposits, our water power resources are not large. Our total water power resources both *developed* and *undeveloped* are something less than 57 per cent of Quebec's *installed* capacity.
3. Manitoba would require only a five-fold or six-fold increase in power development to completely exhaust our water power resources. In the Dominion of Canada as a whole, there was better than a four-fold increase in water power development from 1920 to 1945. In Ontario there was a five-fold increase in power development during the fifteen-year period 1917-1931.
4. Diversions from the Saskatchewan River, to the extent which have been proposed for irrigation by gravity alone would represent a direct loss to Manitoba of approximately 440,000 firm horse-

power or between 12 per cent and 13 per cent of our entire water power potential.

Mr. Russell states that

"If and when pumping on a large scale is resorted to the limit will be raised considerably". It follows, of course, that "if and when pumping on a large scale is resorted to", Manitoba's energy position would be worsened considerably. It should also be pointed out that to whatever extent otherwise economic sites are made uneconomic, Manitoba's reserve of economic power will be, to that extent reduced.

5. In this day and age almost every jurisdiction which has any industrial aspirations whatever is examining very closely into its energy resources and energy reserves. The Province of Alberta, which is bountifully supplied with fuel and energy resources, is now examining into its position with respect to natural gas before permitting export. Having regard to the fact that Manitoba is in a chronically "short" position with respect to fuel and energy sources, our concern about water power, our sole source of energy, will be understood.

Mr. Chairman, this paper was not prepared as an argument against irrigation. The fact is that economic conditions in Manitoba will be favourably affected by whatever steps are taken to produce and maintain higher levels of prosperity throughout the Prairie Provinces. If I were to argue against anything in this matter, I would argue only against what might be called a piece-meal approach to the development of this particular watershed. I think we need a comprehensive approach and that we should treat the watershed as a whole. If we are to do this, it becomes necessary for us to fully examine the needs and interests of each region of the watershed and determine how these needs and interests can best be met. When we have done this, it is necessary that we examine the extent to which these various interests are compatible and how the interests of each region can be met with the least possible deleterious effect upon all others.

I have already offered the opinion that the co-ordinated development of the water and related resources of the Saskatchewan River watershed represents one of the most important and one of the most complex problems in the field of resources management with which Canada is faced today.

Fundamentally it is a problem of inter-relationships and integration. Steps have already been taken with respect to forest protection on the eastern slopes of the Rockies and which recognize the inter-relationships between forest cover and river control. Immense strides have been taken in irrigation which recognize the values which soils and water can give to one another. Investigations have been carried out to determine the possibilities of greatly expanding this work and of enhancing the productivity of other large areas. Some studies have gone forward with respect to the further integration of power and irrigation. Earlier investigations had held out an encouraging prospect that, when additional agricultural lands were required, it would probably be feasible to reclaim for agricultural purposes several million acres in the lower Saskatchewan valley. Still other studies have been made and are going forward with regard to power development in Manitoba; studies which recognize the values which power can give to forest and mineral resources as well as the values which these resources can give to water power.

We have now reached the stage where planning within individual regions of this watershed is not enough. We have reached the time when inter-regional studies should go forward; when the effects upon each region which are likely to follow upon works in each other region should be thoroughly appraised and understood. The setting up of a Western Water Board, which has recently been agreed upon by the Governments of Canada, Alberta, Saskatchewan and Manitoba will be accepted by the people interested in the Saskatchewan River as a most constructive step. This Board, with representatives from the four major jurisdictions concerned in the Saskatchewan River should provide an excellent medium for the co-ordination of engineering work relating to this stream and in addition facilitate the inter-regional studies to which I have referred.

PROVINCE OF SASKATCHEWAN

Submissions of the Province of Saskatchewan to the Royal Commission on the South Saskatchewan River Project

Foreword

The briefs contained in this volume are the results of individual and collective efforts of members of a provincial Irrigation Committee, which has been engaged in a study of the Central Saskatchewan Development for several years. The permanent members of the Committee are: I. C. Nollet, Chairman, W. H. Horner, E. E. Eisenhauer, J. W. Tomlinson, W. B. Clipsham, J. A. Arnot, B. Boyson, R. E. Mackenzie, E. J. Seammell, M. Brownstone, Secretary. In addition to these individuals valuable advice has been rendered by Harold W. Pope, Q.C., Counsel for the Government of Saskatchewan to the Commission, Dr. L. B. Thomson, G. L. Mackenzie, Gordon Watson and W. B. Berry of the Prairie Farm Rehabilitation Administration, Professor David Case-Beggs, W. H. Harding, T. K. Shoyama and Professor F. R. Scott.

We have also benefited greatly from technical studies prepared under Prairie Farm Rehabilitation Administration auspices and wish to acknowledge our debt to the many individuals concerned. Without the concerted research effort of these groups it is doubtful whether an objective and scientific appraisal of the project would have been possible.

Finally, I wish to extend the appreciation of the Government of Saskatchewan to the many individuals and organizations presenting briefs to you, and others who have worked hard for many years to make this great project a reality. While largely composed of Saskatchewan residents this group also includes many individuals from other provinces whose support has been of unquestionable value, demonstrating, as it has, the national importance of the Central Saskatchewan Development.

I. C. NOLLET,
Minister of Agriculture.

GOVERNMENT OF THE PROVINCE OF SASKATCHEWAN

September 11, 1952.

Dr. T. H. Hogg,
Chairman,
Royal Commission on the South
Saskatchewan River Project,
406 Elgin Building,
Ottawa, Ontario.

Dear Sir:

I have the honour to present herewith Submissions of the Province of Saskatchewan to your Commission.

You will please note that six separate Submissions are contained, one a general brief, which I will present and the others covering different phases of the project and presented by various agencies of the Government.

I must note with regret two impediments to a complete statement of Saskatchewan's case in these briefs. First, the details of the Commission's cost estimates were not available to the government for study and comment. In fact, the summarized costs which were made available were reserved by the Commission from comment by this government. Secondly, relevant submissions by other governments were also not available in time for detailed comment in the Submissions. Despite these difficulties, it is the intention of Saskatchewan Government representatives to discuss both questions during the course of the hearings. At the same time, the Government of Saskatchewan wishes to discuss the question of costs more fully when the Commission's detailed estimates are made available.

It is the earnest hope of the Government of Saskatchewan that these Submissions will be of assistance to the Commission.

Yours sincerely,

HON. I. C. NOLLET,
Minister of Agriculture.

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PART I

GENERAL SUBMISSION

1. *Introduction*

The Royal Commission on the South Saskatchewan River Project was appointed by the Government of Canada, under the terms of Order in Council P.C. 4435, dated August 24, 1951, and charged with the following terms of reference:

1. Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;
2. Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

Comparative measurement of costs against economic and social benefits can often be quite abstract and nebulous. For instance, an indication of economic and social benefits as justified by costs might be compared to the fact that the people of Canada in 1951 spent \$1,446,000,000 on alcoholic beverages, tobacco, race tracks, soft drinks and commercial recreation, but the justification of this type of expenditure on the basis of economic and social returns and desirable resource use has not even been questioned by governments.

When the economic and social benefits of irrigation and power development are balanced against capital costs, it is well to be reminded of the fact that water harnessed as a source of energy, unlike other resource energy, is unexpendable both for electric power and irrigation purposes. It is true that costs of public projects have increased materially. It is, nevertheless, also true that as a result of economic expansion and development generally in Canada in recent years, purchasing power and ability to carry costs, have also increased very materially. Increased costs have not deterred public investment in useful public enterprises. Never in the history of Canada have so many public projects been undertaken at all government levels, with many more public projects being planned for the future. In fact, Canada is committed to the gigantic St. Lawrence Seaway. All of these factors must be considered in dealing with the Commission's terms of reference.

In these introductory remarks I would like to briefly outline Saskatchewan's agricultural production problems and the effects of these problems on the provincial and national economies together with a summary of the impact of the development on these areas.

The total area of Saskatchewan is over 161 million acres, the land area being over 152 million acres, and the area of water well under 9 million acres. These figures clearly illustrate the disproportionate amount of land to water. By far the largest area of water exists in the northern part of the province outside the agricultural area. The above figures, when coupled with low, uncertain precipitation and a high evaporation factor, leave no doubt that agricultural and economic instability in Saskatchewan is related principally to moisture deficiency.

There are approximately 60 million acres of land covered by soil surveys in the occupied agricultural portion of the province. Of this area, over 33 million acres are under cultivation, or approximately 40 per cent of the total cultivated acreage in Canada. It is worthy of note that only 7,833,000 acres of cultivated land is classified as "best to very good wheat land" leaving 25½ million acres which require balanced rotation land use farm practice. This acreage, together with an additional 27 million acres unsuitable to cultivation, strongly implies increased emphasis on livestock production in the interest of full and proper utilization of land resources and a stable agricultural industry. Livestock, in turn, depends on an assured supply of feed obtainable through irrigation development. Thus, an irrigation green spot in the centre of the agricultural area of Saskatchewan will be of immeasurable benefit to agricultural stability.

Saskatchewan is a province of great potential production under favourable moisture conditions. On the other hand, no other province has experienced Saskatchewan's violent and disastrous economic fluctuations. Saskatchewan's production history is marked by drastic fluctuations due to moisture hazards; for example, wheat production in 1942 was 305 million bushels; in 1937, it dropped as low as 36 million bushels; and in 1936, 110 million bushels were produced despite the fact that the larger acreage was sown to wheat in the latter years. As a result of these conditions private businesses and public services, both municipal and provincial, are under a constant threat of disruption. The latter organizations have been and are exposed to the financial burden of relief liability which is shared to an important extent by the Federal Government.

What role has the Government of Saskatchewan played in overcoming our production problems? Let me say, firstly, that the Saskatchewan Department of Agriculture considers the need for agricultural stability to be of paramount importance to a sound provincial economy. In fact, the cornerstone of the Department's agricultural policy is, first, agricultural stability and,

second, increased production resulting from good land use practice and optimum development of all irrigation and reclamation possibilities. The Department of Agriculture has directed all its major activities to this end and has increased expenditures with these basic objectives in mind. To make this possible the votes for the Department of Agriculture have been increased from \$826,000 in 1945-46 to \$3,666,000 in 1952-53.

Part of this increase is reflected in a greatly expanded field extension service for the primary purpose of improved land use practice and the initiation of worthwhile projects that will bring greater security to our farmers. The Agricultural Representative Service covers the entire province with Agricultural Representatives living within their respective districts. The Agricultural Representatives work in close association with local agricultural committees whose principal attention has been focussed on Saskatchewan's major problems. Innumerable valuable land use and settlement studies have been made by these committees that indicate clearly the comprehensive steps necessary to bring stability and security to Saskatchewan agriculture.

In order to meet present and anticipated needs, the department has set up a new branch known as the Conservation and Development Branch charged with the responsibility of undertaking physical development of irrigation drainage and dry land projects. This branch itself has an appropriation of nearly \$1,350,000 for 1952-53. It is well to mention that previous to the inauguration of this branch there were no engineering specialists and no equipment in the department to implement the above programme. Since the establishment of the C. & D. Branch, the scope of activities of this branch can be gauged by the fact that 45 water users associations are now organized; water has been brought to 50,000 acres of land; 145 miles of ditch has been constructed; 475,000 acres of dry land projects developed; and 1,000,000 acres of land affected by drainage improvements. Thirty-three field survey parties are in the field this summer. I refer to the activities of this branch merely to indicate that the department has a well organized expanding agency staffed with competent technical personnel to meet present and future requirements for irrigation, reclamation and other activities associated with overcoming the many natural hazards facing Saskatchewan agriculture. Trained technical staff, equipment and experience places the department in a good position to undertake the responsibilities associated with the Central Saskatchewan Development.

I should make brief reference to the activities of the Lands Branch. The administration of Crown lands in Saskatchewan is devised to fit into the general policy aimed towards agricultural stability and security. Provincial Crown lands are utilized wherever possible to establish community pastures, fodder projects of various types, including irrigation, reclamation and dry land projects. Crown lands have been made available for the establishment of P.F.R.A. community pastures, provincial community pastures, co-operative pastures and co-operative community fodder projects, and the establishment of as many economic farm units as possible with available Crown lands. Earned assistance is made available to municipalities or groups of farmers who wish to develop pasture or fodder projects within the resources of such groups, with the department paying 50 per cent of the actual development costs. Larger projects of this nature are constructed exclusively by the provincial department and, of course, as mentioned above, P.F.R.A. has made a very substantial contribution in the establishment of community pastures on Crown lands made available by the provincial government. Administration of Crown lands in Saskatchewan is characterized by meticulous inspection by competent soil specialists in order to determine the proper utilization of land for grazing or cultivation purposes, and also to determine the size of a potential economic farm unit in accord with the productive classification of the land. The Lands Branch exercises every caution against permitting land to be utilized for wheat production that is not suited to this type of agriculture. The department is primarily interested in good land use practice and the optimum utilization of our total Crown land resources in order to assist in stabilizing Saskatchewan agriculture and increasing production to the optimum. The Lands Branch has also inaugurated new settlement projects in the limited area remaining in north-east Saskatchewan.

It should be quite clear from the foregoing that this government, working with federal and local groups, is making every effort to cope with our agricultural problems. What can the Central Saskatchewan Development contribute?

With respect to agriculture, the development will remove the threat of crop failure from almost 450,000 acres of land which is now extremely vulnerable to drought conditions. It will permit changes in land settlement patterns which will eventually place upwards of 4,000 farm families on a secure and permanent basis. It will allow essential changes in land use both within the project and in a considerable area surrounding the project and will permit widespread

diversification in the economy. If this project is not constructed there is little hope of avoiding the effects of adverse climatic conditions on the economy. The only basic solution within agriculture is, firstly, to provide assured feed supplies, and secondly, to provide more land to farmers in the arid areas by resettling a portion of the farm population. It will be shown that Saskatchewan is suffering acute land hunger at present. There is simply not enough land to permit needed adjustments. But irrigation development does provide "new" land with eight to ten times the population carrying capacity of dry land and it is for this reason that the development can play a vital role in promoting a stable agriculture in the province, apart from its purely local stabilizing effect on the project area. Without this vital contribution little progress can be made in Saskatchewan towards modification of the effects of natural hazards inherent in our soil and climatic conditions. By this token there is no assurance that the tragic occurrences of the "thirties" can be avoided including the huge relief expenditure of \$187,000,000 and the immeasurable destitution of the land and its people.

I wish to stress briefly at this point that, in particular, agricultural resettlement problems in Saskatchewan are more pronounced than in any other province. New land settlement opportunities in Saskatchewan are now very limited and confined largely to reclamation and irrigation possibilities. No new land areas of consequence remain available for dry land settlement. By contrast, Alberta has at least ten acres of new dry land settlement opportunities to every one acre still available in Saskatchewan, including drainage-reclamation projects. Alberta has irrigation water already allocated from interprovincial streams for 1,256,000 acres of land, while Saskatchewan, from such interprovincial streams has an allocation for only about 30,000 acres. Furthermore, Alberta has 700,000 acres of irrigable land for which water has been allocated and on which development has not, as yet, taken place.

It is quite evident that by comparison, and on the basis of need, Saskatchewan should now be favourably considered for irrigation settlement opportunities. Very little large scale irrigation development will be possible in Saskatchewan apart from the Central Saskatchewan development and limited development based on diversions from the North Saskatchewan.

A second major contribution of the project will be food. If Canada is expecting to support a large industrialized, urban population within the next few decades it will be necessary to increase existing food supplies. Already the highly industrialized provinces are deficient in certain needed foods and this will be

aggravated as industrialization proceeds. There are few remaining areas for agricultural development in Canada. The only real alternative to more intensive use of land, such as would occur under irrigation, is to look to other countries for our supplies. But the opportunity for large-scale food imports is rapidly shrinking in the world. Furthermore, it is difficult to assume reliance on imports in the face of unsettled world conditions.

A third contribution is hydro-electric power. If the project is not constructed an annual potential of upwards of 400 million kilowatt hours will be wasted and downstream power potential will be reduced. This power is crucial to the electrification of our rural areas and to industrialization.

Saskatchewan has only two main sources of hydro power, the North and South Saskatchewan Rivers. The development will assist immeasurably towards providing electric power to Saskatchewan people on a more equitable basis with other provinces.

Fourthly, there are important contributions in the fields of municipal water supply, flood control, recreation and industrial development stemming from the Development. While perhaps not as dramatic or as large as the agricultural, food and power benefits, they will be important contributions to urban development, standards of living, and diversification of our economy.

Over and above the foregoing contributions we must also consider the general national benefits. This, when measured in terms of additions to national income, amounts to many millions annually. These millions will be added to income in every corner of the nation, in food processing plants, in transportation facilities, in electric appliance factories, in mines, mills and smelters and in the farm implement industry, the fertilizer industry and many others.

But what is perhaps even more important, it will result in a more stable national economy and a more united nation. The threat of an unstable wheat economy will be greatly modified by the stabilization effects of the Development and its industrial opportunities. In terms of a national development policy, which has not been evident in Saskatchewan for many decades the prospect of investment in the Development provides the federal government with an excellent opportunity to demonstrate its interest not only in redistribution of income in welfare schemes as a national policy but also in the development of resources.

The Central Saskatchewan Development represents a unique potential productive unit, composed of available soil, water and human resources, which can be utilized most effectively only through the completion of the Project. The Central Saskatchewan Develop-

ment presents the most feasible and practical use of water for irrigation and power. It represents the cheapest and most efficient way to convey water to the point of development, that is, by natural channel flow. Furthermore, it is important to note that free waters in the South Saskatchewan River Drainage Basin will remain unutilized and lost unless this greatly needed project is proceeded with. It is evident that on the basis of greater need and benefits, both provincial and national, Saskatchewan is entitled to the utilization of these interprovincial waters as a matter of right and in the interest of an equitable division of these great water resources between the provinces concerned. This nation cannot afford to waste these resources any longer. It cannot permit the problem of an unstable economy to drift on the tides of natural and economic fortune. Nor can it ignore an annual loss of many millions of additional national income through failure to make an investment in the Development. The Development has been thoroughly studied and the results of these studies indicate that construction should be undertaken without delay.

The Saskatchewan Government urges the early construction of the Central Saskatchewan Development.

2. The Project and Its Potential Development

A survey of the project area will indicate clearly that it is a typical prairie problem area. It is characterized by a low and uncertain precipitation, a very low proportion of good dry land soils, generally undersized farms and a predominance of wheat production. As a result of these factors, farm incomes have been historically low and unstable, the incidence of relief payment very high, and depopulation has occurred since 1930. The entire structure of the rural community has been thereby adversely affected.

On the other hand, some of these very factors combined with others make the Area one of the most favourable for irrigation purposes. Let us examine them briefly.

With respect to soils, intensive surveys of soil conditions within the Development Area have indicated a superior irrigable area, perhaps unequalled in Western Canada. In sharp contrast to the very low proportion of soils in the Area rated as good for dry land wheat production (8.3%) over 71 per cent of the net irrigable acreage (430,000 acres) are in the two top grades for irrigation farming. Furthermore, topographical conditions are such as to permit relatively easy irrigation.

With respect to climate it has been established that the Elbow-Outlook district is one of the most arid on the Prairies and, furthermore, that effective precipitation in the Development Area is probably less than

in the arid sections of Alberta. Frost free periods in the Area are approximately of the same duration as those in irrigation areas of Alberta. There is no doubt that large seasonal deficiencies of moisture prevail in the Development Area and that it would benefit greatly from ample water supplies.

It is quite clear, therefore, that this is an Area which needs water and can use it effectively. In physical terms, therefore, only the availability of irrigation water and the practicability of bringing it to the soil remain to be established. There is little doubt that these two criteria can be fulfilled.

Independent studies have indicated that sufficient water is available in the South Saskatchewan River to meet all irrigation requirements of the Development (960,000 acre feet annually). Furthermore, a report of the Prairie Provinces Water Board shows that there is enough water to produce annually 50,000,000 kilowatt hours of pumping power, 325,000,000 kilowatt hours firm commercial power, and 100,000,000 kilowatt hours secondary energy over and above satisfying all irrigation needs.

On the basis of P.F.R.A. reports which have been substantiated by recognized authorities such as Gen. H. B. Ferguson, U.S. Corps of Engineers, and Dr. A. Casagrande, Harvard University, the Saskatchewan Government is satisfied that the suggested main dam is feasible from an engineering viewpoint. This structure will create a reservoir whose capacity (8,000,000 acre feet gross and 4,000,000 acre feet live) assures virtually perfect river control.

The planned distribution system is also considered feasible. It is a compact system and thus avoids the necessity for construction of a multiplicity of reservoirs, as well as minimizing the transportation and evaporation problems encountered with lengthy canals.

Having established the agricultural and engineering feasibility of the project we might proceed now to examine its potential development. What can be done with the water stored in this immense dam and reservoir? What is the expected utilization of this virtually new resource?

(i) Agricultural Development

The nature of the transformation of agricultural output on the Central Saskatchewan Development rests basically on two broad factors. The first may be described as "natural" and "engineering" and the second "economic."

On the basis of engineering and soils data, it is suggested that at least 430,000 acres of land or about 2,700 farms, in the Development Area itself (and an additional 20,070 acres in the Qu'Appelle Valley) can be

irrigated with satisfactory results. Soils and climatic data just reviewed suggest that a wide range of irrigation crops can be grown successfully.

Economic factors, while of great importance, do not readily lend themselves to precise analysis. In the main, two broad economic questions are involved: the nature and extent of demand for food, and production alternatives. Demand factors, as will be shown later, indicate an overall increase in demand for food, as well as a relatively larger demand for meat, milk, vegetable and fruit products. While necessarily stated in general terms, this projection should serve as a guide to expected tendencies in food consumption in Canada. The needs of the national market can be expressed in terms of a shift from cereal consumption to animal products and various row crops.

Given the foregoing conditions, it is then necessary to integrate them with production factors, in order to arrive at some estimate of agricultural development under irrigation. The irrigation farmer, in brief, is faced with a situation where natural factors permit him to produce a wide variety of crops and where demand conditions favour a relatively larger output of animal and vegetable products as compared with cereals. He must utilize his productive factors to yield him the highest possible net income over a period of time.

By taking all of these basic and other related factors into account it is possible to project the development of agricultural output under irrigation in the Central Saskatchewan Area.

(a) *Types of Farming*.—A general assumption of a livestock-cereal grain economy receives ample support from demand and production requirements. When land is first brought under irrigation on the project and during the first few years of settlement, grain will be the principal crop grown. This must be so while land is being levelled and ditches properly located. However, once this is accomplished, new irrigation farmers can start planning towards a cropping program which will be aimed at obtaining the highest income per acre and maintaining soil fertility. Experience in other irrigated regions has shown clearly that continuous grain cropping cannot be carried on profitably under irrigation. A rotation which includes forage crops and legumes must be established if high production is to result. The typical farms envisaged in Part II of these Submissions are based primarily on livestock-forage crop and grain production with specialty crops replacing wheat production in the mature phases. Further integration of these farms with surrounding agriculture will, undoubtedly, take place. In fact, it is essential that an optimum integration be developed as quickly as possible. Further

expansion of feeder enterprises would be made possible by utilization of by-products of certain specialty crops. Specialty crop production with attendant livestock feed by-products will also develop into significant enterprises in the area. Under market conditions expected, both specialty crop production and the livestock feeding business would probably be more profitable than the beef-cereal enterprise.

(b) *Expected Changes*.—With the above in mind, it is possible to visualize the changes in agriculture which will take place as a direct result of the development. These are based on initial development:

- (1) On the basis of 160 acre farms the farm density in the area will be more than doubled.
- (2) Total agricultural output will be at least three and probably four times the present output. This is derived from the expected increase in yields and a more intensive use of land made possible by elimination of summerfallow practices. It is expected that the area will produce for commercial disposition nearly 3 million bushels of wheat, more than 40 million pounds of beef, about 3,750,000 bushels of coarse grains and over 60,000 tons of hay. This output is in sharp contrast to the present relatively low average annual output in the Development Area.
- (3) Grain production will be largely replaced by livestock, grass and forage crop production, together with expanding possibilities for specialty crops.
- (4) Feed supplies for livestock production throughout large areas of the province will be assured. The availability of feed will permit a more intensive use of pasture areas; and the periodic decimation of herds because of drought conditions will be avoided.

The Central Saskatchewan Development can thus play two major roles. Firstly, it can add greatly to agricultural stability by rehabilitating not only farmers in the project area but also farmers from other problem areas who will be settled on new farms created; by providing assured feed supplies for livestock throughout the province; by providing a large area of permanent and stable agriculture in the heart of the province. Secondly, it will supply needed food for our citizens.

(c) *Settlement and Utilization Problems*.—Notwithstanding the general validity of the foregoing description of expected agricultural results of the development, the question of ways and means of assuring the actual realization of projected farm sizes, types and output must receive careful consideration. This involves problems of land tenure, education, colonization and

finance. Policies must be developed in each of these aspects to insure optimum conditions for the achievement of the expected results. It is essential, in short, that the public investment contemplated be adequately protected.

Some of the common hazards of irrigation development are well known. These include lack of experience on the part of settlers; speculation in land values; overburdening of the financial capacity of settlers in early stages of settlement; and deficient utilization of land due to large holdings or excessive charges.

Lack of experience in irrigation farming can be dealt with by well planned extension and demonstration services. Experience with the Soil Conservation Service in the United States indicates that farmers can plan very satisfactorily for better land use through new farming methods with the assistance of qualified technicians. Some of the reservations about the ability of dry land farmers to adapt to irrigation farming would not seem to be well founded in a situation where an imaginative extension program was instituted.

Demonstration stations would also serve to overcome lack of experience of the new irrigation farmers. It is gratifying to note the excellent progress of the P.F.R.A. predevelopment farm at Outlook which will serve both as an experimental unit and a demonstration farm. This could be combined with the settling of experienced irrigation farmers at random through the area, thus making their experience available to the entire neighborhood.

The other problems of irrigation farming (apart from financing the project itself) hinge largely on land policies. Speculation in land and the creation of large holdings must be dealt with by developing strong government policies. Generally speaking, there are two types of land policy which may be employed to insure financial stability and proper utilization of resources. The first would rely on private ownership of land together with comprehensive regulatory devices to control abuses. The second could be based on public purchase and long term leasing or resale provisions. It is possible to pursue either of these alternatives or a combination of the two.

The Saskatchewan government is willing to proceed in any negotiated method of land control either by itself or in conjunction with the Federal government which will avoid the abuses from speculation under private ownership and which will guarantee good land use, in that way protecting the public investment in irrigation development.

(ii) *Power Development*

The impounding of South Saskatchewan waters will not only provide for irrigation but make available a large supply of sorely needed hydro-electric power.

The Coteau Creek Dam alone will permit the annual generation of 475 million kilowatt hours of energy (325,000,000 Kw. hrs. firm commercial energy, 100,000,000 Kw. hrs. secondary power and 50,000,000 Kw. hrs. pumping energy). In addition, the excellent river control provided by this dam will directly increase the potential of the proposed Fort a la Corne project by another 100,000,000 kilowatt hours of energy. It is highly likely that other downstream sites will benefit in the same way in the future.

The immediate additional power output which will result from completion of the Central Saskatchewan development will, therefore, amount to 575 million kilowatt hours, assuming the probable completion of Fort a la Corne by that time. As an alternative to more expensive types of generation, this large block of energy will be integrated with other generating centres into a provincial grid which must be built up very soon to meet rising demands.

The power made available by the project will have many uses. It will be used to provide pumping power to lift irrigation water. Secondly, it will be used within the project and the area contiguous to it to supply farms and rural communities with power. Thirdly it will be used for increasing domestic and industrial loads, and fourthly, it will be used as an important element in the overall provincial power system.

(iii) *Municipal Water Supplies, Recreation, Flood Control and Industrial Development*

These will all be important aspects stemming from the initial construction of the main dam and reservoir, as well as the irrigation project itself.

In dealing with municipal water supply it must be recognized that drought presents a serious problem to urban communities as well as to rural areas. Lack of a proper water supply can effectively limit domestic and industrial expansion, power production and living amenities.

The proposed development would be of significant financial assistance to the Buffalo Pound Lake water supply scheme for Regina, Moose Jaw and other municipalities. The present design of this project calls for pumping of water from the South Saskatchewan River to a canal leading to Buffalo Pound Lake, where it will then be filtered, treated and pumped by pipeline to the cities. Construction of a dam at Coteau Creek will eliminate this pumping. Some pumping equipment will, of course, be purchased immediately.

However, additional pumping equipment required by 1980 and involving a capital expenditure of \$350,000, would be saved by completion of the dam. In addition, annual pumping costs of \$150,000 will be saved. Other municipalities in the Qu'Appelle-Assiniboia River system will also benefit from improved quantity and quality of water supplies.

Vast potential recreational facilities will be possible with the completion of the Central Saskatchewan development. An immense main reservoir with 400 to 500 miles of shoreline will be created. Lake levels of Last Mountain Lake and of the Qu'Appelle Valley Lakes will be restored and maintained, to the lasting benefit of many resorts. These advantages will serve the double purpose of providing more accessible recreation areas for Saskatchewan residents and of attracting a larger tourist trade.

The creation of the large reservoir proposed will also have a marked effect on the flooding problem in Western Canada. The river control provided will contribute materially to the reclamation of lands in the Carrot River Triangle, which are now subject to annual floods.

Finally, considerable industrial development will occur as a result of the development.

The new investment which will result from the project will cause increased expenditures for both consumer and producer goods. This will aid in attracting new industries to Saskatchewan and will encourage expansion of existing facilities. The increased purchasing power and farm investment which will result from greater production will also bring about an increased demand for goods. New processing industries, to process the added production of the area, will be established, and existing industries will be expanded. In addition, manufacturers will find many more factors favourable to the establishment of new industries.

It is essential to note that the industrial effects will be nation-wide in scope not only with respect to food industries, farm supplies industries, fuel industries and others but to the primary industries as well. The mining industry of Nova Scotia, the lumber industry of British Columbia, the packing industry of Ontario and many other industries and areas will feel the impact of the development.

* * *

In the foregoing chapter the actual project and its potential development were outlined. The remainder of this submission will be devoted to discussing the actual impact of the development on the provincial and national economy and largely in terms of the needs of these areas for this project and its products.

3. *The Need for Further Stabilization of Saskatchewan Agriculture*

An abnormal degree of instability and insecurity still prevails in the agricultural economy of Saskatchewan. This is due primarily to limited annual rainfall and periodic drought. The high incidence of crop failure is further aggravated by price fluctuations, thus causing an instability and insecurity of income which is much more severe in Saskatchewan than in other provinces. While considerable progress has been made by federal and provincial agencies in developing conservation and reclamation programs we have not yet realized the large scale changes which are required, thus leaving the provincial economy in a dangerously vulnerable position.

What must be done to overcome these deficiencies which are so highly injurious to the economic and social fabric of both the province and the nation? Leaving aside consideration of general national economic and social policies, several possibilities within agriculture present themselves:

- (1) The economy can be diversified and stabilized by irrigation production.
- (2) Individual income can be stabilized, by adjusting the size and use of production units.

In discussing the above problem and its solutions, it may be most useful to deal first with the problem of diversification and, second, with resettlement.

(i) DIVERSIFICATION OF PRODUCTION IN SASKATCHEWAN

Our Department is making great efforts towards increasing the production of livestock and livestock products. In this we are supported enthusiastically by a great many farmers who contribute to our extensive program in Municipal Agricultural Committees and District Boards. In spite of this, our present livestock population, excluding horses, remains at about the 1921 or 1922 level. We have, now, including horses and poultry, less than one animal for every 15 acres of cultivated land.

One of the important reasons for our lack of livestock is the uncertain supply of winter feed. Our history as a Department includes a long list of fodder problems, of buying hay and shipping it by rail at tremendous expense to keep cattle alive throughout the winter. In the prairie areas of the provinces grasses and clovers are uncertain low yield crops—without water. Only in better than average years will they produce as much as a ton per acre. Efforts to obtain stands result in a percentage of failures depending on the area and the weather following seeding. As a result most of the cattle in the prairie areas are

wintered on slough hay or on straw. Winters may start in October or late December and end in March or mid-May.

Farmers throughout the prairie parts of Saskatchewan know only too well what a crop failure means when livestock are kept. Our worst experience was in 1937. Between September 1, 1937 and August 31, 1938, more than 450,000 tons of fodder were shipped by governmental agencies—this even after a liquidation of 611,574 cattle for canning purposes at 1-1½ cents per lb. had occurred. In that year alone more than \$3,500,000 was spent in freight moving hay, feed grain and seed.

We hope that this will not happen again—but in each of the years, 1945, 1947, 1948 and 1949, it was necessary to ship hay into Saskatchewan to supply areas that had suffered a failure of hay crops. During that period hay has moved from The Pas, Manitoba to Prince Albert and Saskatoon, from Brook, Alberta to Moose Jaw and Swift Current, even from the Inter Lake country of Manitoba as far as Saskatoon, with freight charges, as far back as 1948 running to \$10 per ton.

Perhaps it is little wonder that many farmers, in this area, even though they would like to do differently, refuse to accept the risk of keeping livestock. That they have done so is illustrated by a cattle population in Census Division 11, which contains a large part of the project, of 54,000 cattle as compared to populations of 75,000 and 90,000 cattle in Census Divisions 9 and 10 respectively.

The Saskatchewan Government has viewed this matter of recurring fodder shortages as one of our major production problems. We have established a Conservation and Development Branch to bring into production every acre of irrigable land as quickly as possible. We have undertaken very sizable expenditures to reclaim clay land for fodder production, accepting the fact that yields are low and uncertain. We have undertaken to accumulate fodder reserves in the hands of the Department even though we recognize that it is extremely expensive and that such reserves can, at best, be totally inadequate to meet a real emergency. We share the cost equally with any municipality or groups that wish to develop an area to grow winter feed. Accepting the fact that fodder production in much of the prairie area is hazardous we have undertaken an all out extension program and have offered assistance in the sale of forage seed to encourage farmers to try to grow more fodder.

None the less, we are today probably even more vulnerable to crop failure and fodder shortages than in 1937. Fifteen years ago we had sizable reserves in the form of straw piles that are now a thing of the past. It is no exaggeration to say that another year such as 1937 would deal our livestock industry and the whole concept of conservation through livestock production a crippling blow which might be effective for decades.

In 1949 a total crop failure (less than three bushels per acre) occurred in about 63 municipalities and L.I.D.'s. A most serious situation was averted only through an intensive campaign, a good hay crop in south-eastern Saskatchewan and south-western Manitoba, the movement of more than 30,000 tons of hay with government assistance, and a reduction in size of many herds in the area. The use of a few thousand tons of hay in our reserves forestalled a major disaster in the late spring of 1948, following a poor hay crop over about one-half of the province. Many farmers within a few miles of the irrigable area of this project carried their cattle through with seed wheat and the old straw roofs of sheds.

* * *

It is apparent, therefore, that little progress can be made towards diversification without considerably more protection against feed deficiencies. The Central Saskatchewan Development provides us with an opportunity to establish sure crop areas, a high yielding area within only a few miles of some 25 municipalities in the heart of a very dry region and within almost 150 miles of our whole crop failure area. This area would provide assured production of fodder, of feed grain and of seed grain. It is completely surrounded by an area of farming land in which production is anything but certain.

(ii) ADJUSTMENT OF FARM SIZES—RESETTLEMENT

In the light of production experience and various other factors it has been evident for some decades that the original pattern of settlement in Saskatchewan has resulted in a problem of undersized farm units. Over large areas our farmers have found that they have insufficient land to combine with modern, efficient machinery in order to produce a satisfactory farm income. To counteract this serious condition, slow and painful adjustments have taken place over the years. Since 1911, for instance, improved acreage per farm in Saskatchewan has almost tripled (Table 1).

TABLE 1—*Changes in Farm Sizes, Saskatchewan, 1911-1951*

Year	Occupied Acreage/Farm	Improved Acreage/Farm
1911	295.7	125.0
1916	353.8	188.7
1921	368.1	209.6
1926	390.1	235.3
1931	407.9	245.8
1936	399.6	236.2
1941	452.3	256.5
1946	472.5	283.7
1951	550.4	346.4

Source: *Census of Canada*, 1911 to 1951, inclusive.

That this process has been accompanied by great cost in both economic and social terms is evidenced by the huge relief and similar expenditures from 1907 to 1951 (Table 2).

TABLE 2—*Financial Assistance to Saskatchewan Farmers 1907-08-1950*

Debt adjustment and tax cancellation	\$125,000,000
Relief*	186,500,000
Federal programs**	153,600,000
Total	\$465,100,000

*—Including relief advances for agricultural assistance and direct relief, 1907-08 to 1940-51. Most of this sum was actually paid out in the decade 1929 to 1939.

**—Including P.F.A.A., P.F.I., and W.A.R., payments, 1939-1950 inclusive.

Source: Statistics Branch, Saskatchewan Department of Agriculture. D.B.S., *Handbook of Agricultural Statistics*, Part II, February, 1952.

Nevertheless, uneconomic farm units still persist in large numbers and present a continuing threat to our economy. Our Department of Agriculture in attacking this problem has stated:

"The average minimum size of farm required for an economic unit in Saskatchewan, even on some of the better soils, is three-quarters of a section. In 1941, two-thirds of Saskatchewan farmers had less land than this minimum. At least one-quarter of these have an urgent need for additional land, to the point where they have an actual problem of resettlement. In other words, there are approximately 20,000 Saskatchewan farmers with an urgent resettlement problem and an additional 40,000 who require additional land to make their present units economic and secure."¹

¹ Province of Saskatchewan, Department of Agriculture, *The Allocation of Northern Lands*, 1952, p. 2.

I would like to stress here that the problem of lack of sufficient farm acreage is not confined solely to the southwestern or central portion of the province but is also a feature of the pioneer areas in the north where similar settlement errors have been committed. Settlers were moved from the drought areas to those regions only to find themselves faced with years of backbreaking struggle to carve out workable acreages. Their needs for land must receive a high priority.

Although it is difficult to state categorically the desirable size of farms in the various areas of the province, it can safely be assumed that as a bare minimum alternative employment must be found for operators of 10,000 units throughout the province. The need for alternative employment might be avoided by technological, physical or economic changes which would result in a greater population carrying capacity in presently depressed areas. But the scope for such changes is severely limited. More drought resistant crops, higher wheat prices and lower costs of input factors are all rather distant possibilities. A redistribution of land holdings in some very limited areas where excessive land concentration has taken place must also be regarded as similarly remote. Probably some progress could be made by making satisfactory credit available in certain areas but, in the main, the use of this credit would involve purchase of additional land and consequent displacement of some farmers. By and large, therefore, the solution is one of economically resettling a considerable number of Saskatchewan farmers. Such resettlement will permit the absorption of vacated farms, as a means of increasing farm sizes in deficient areas. It is necessary, then, to consider what avenues are available in Saskatchewan to provide for such a resettlement program.

(a) *Irrigation*—The only known irrigation resettlement possibilities of any consequence in Saskatchewan are those of the Central Saskatchewan Development. It is quite apparent that, apart from the South Saskatchewan River, practically all of the streams have already been allocated to existing projects or projects which are in some stage of completion. In fact, shortages in some of the watersheds are preventing complete utilization of some projects. It will be pertinent to review these briefly.

(1) *Small Projects*—In the main, small projects² do not permit the establishment of new or additional settlement units. These small projects are limited in their usefulness to stabilizing existing dry land units.

² Including dugouts, stock watering dams and individual projects.

- (2) **Organized Projects**—These range in size from several hundred up to 20,000 acres and are largely located in south-western Saskatchewan. Because of water shortages and soil restrictions, it is expected that a maximum of 120,000 acres will comprise the organized project category. A considerable portion of this acreage has already been developed and settled.
- (3) **Special Projects**—This category includes major developments in Alberta and Saskatchewan such as the Red Deer Project, the Canada Land Project, St. Mary's Project and the Central Saskatchewan Development. The development of these relatively large projects in Western Canada offers excellent opportunity for resettlement of what are now relatively unproductive farms and will also permit stabilization of farmers within project areas. Use of the projects for resettlement purposes will permit desirable enlargement or change in land use by the use of vacated dry land farms.

The total land area contained in these projects is in the neighbourhood of some 1.4 million acres which would contain approximately 9,000 farms (assuming irrigation farms to be 160 acres in size). However, some allowance must be made for dry land farmers existing now on these irrigation areas and it is quite probable, making this deduction, that only about 5,000 units will be available. Of these available units it is doubtful whether more than 50 per cent or 2,500 farms will be made available to Saskatchewan farmers. In fact, the figure of 50 per cent appears unduly optimistic since the Provincial Government of Alberta will control the St. Mary's and the Red Deer Projects and may not be in a position to offer irrigation farms to Saskatchewan farmers when the needs of Alberta farmers have to be met.

(b) *Northern Settlement*.—Various estimates have been made regarding the amount of land susceptible to settlement in the northern areas of Saskatchewan. These estimates must be modified for purposes of planning resettlement since a portion of the land must be made available to undersized units within the pioneer regions. C. C. Spence makes this adjustment in his estimate,³ and estimates that 3,000 units are available for resettlement.

While this may seem unduly conservative, it is even more liberal than the estimates of the Provincial Department of Agriculture which states that a maximum of 2,400 new units can be made available in the north.

From this brief survey of settlement possibilities it is clear that every feasible project must be fully

exploited, in order to alleviate the pressure for readjustment of uneconomic farm units in Saskatchewan. Complete development of all foreseeable irrigation or northern settlement schemes can, at best, provide for 5,500 additional units whereas the actual requirement is in the neighbourhood of 10,000 new farms or its equivalent acreage.

The Central Saskatchewan Development presents an excellent opportunity for rehabilitation of depressed and insecure farmers. Furthermore, the vacating of farms in certain arid areas of the province will permit enlargement and stabilization of remaining farms.

(iii) SUMMARY

I have attempted to touch on two of the major needs of agriculture in Saskatchewan (apart from market and price considerations). There is great need firstly for assured feed supplies to permit increased diversification of the economy through livestock production and, secondly, for new land on which to resettle insecure farmers. Neither of these needs can be adequately filled without the Central Saskatchewan Development. Construction of this project will be a great step forward towards meeting the need for a mature and stable agricultural economy in Saskatchewan. How can we merely calculate in terms of dollars and cents what it might be worth to us. Is it any wonder that the Government of this province is anxious and ready to make its investment in the project—that we are so eager to see it started.

4. *The Need for Hydro-Electric Power in Saskatchewan*

The lack of abundant low cost electric power has limited the economic development of Saskatchewan. Saskatchewan's relatively inferior position is illustrated by the following table which shows that this province ranked eighth in annual per capita electric power consumption in 1951.

The deficiency in electric power is evident throughout the provincial economy. In urban centres the rate of industrialization has been retarded, and in many communities the numerous amenities made possible by availability of abundant electric power are still lacking. In rural areas, and particularly on farms, lack of this and other facilities has had a profound effect on the very structure of rural life. Steps are being taken to correct this situation but the potential demand is many times greater than available generating capacity.

³ C. C. Spence, *Land Settlement in Western Canada*, "Economic Annalist", May, 1946, p. 40.

TABLE 3—Total and Per Capita Electric Power Consumption in Canada, 1951

—	Total	Population June 1, 1951	Per Capita Consumption	Rank
	000 Kw. Hrs.			
Canada.....	55,031,924	13,984,329	3,935	
Newfoundland.....	125,607	361,416	347	9
Prince Edward Island.....	23,399	98,429	237	10
Nova Scotia.....	875,380	642,584	1,362	6
New Brunswick.....	716,915	515,697	1,390	5
Quebec.....	24,124,977	4,055,681	5,948	1
Ontario.....	20,571,220	4,597,542	4,474	2
Manitoba.....	2,928,912	776,541	3,772	3
Saskatchewan.....	457,465	831,728	550	8
Alberta.....	1,021,073	939,501	1,087	7
British Columbia....	4,186,972	1,165,210	3,593	4

Source: D.B.S., *Central Electric Stations*, December, 1951.
Department of Resources and Development, Water Power
Resources of Canada, March, 1952.

The following estimates of present and potential loads on the provincial power system have been made:

Year	Load (million kwh)
1949	346
1954	635
1959	1,172
1964	1,764
1969	2,411

Almost eight times the present power will be required by 1970 to meet expected demands. The large block of energy which will be made available by construction of a dam on the South Saskatchewan River near Coteau Creek could, therefore, play a vital role in the future progress of Saskatchewan.

In relating the province's obvious need for economical and abundant electric power to the Central Saskatchewan Development, data on consumption of electric energy in the area adjacent to the Development have been compiled and projected to 1968.

The loads include all consumers in the North Battleford-Saskatoon-Prince Albert system, the Unity-Kindersley system, the Swift Current-Moose Jaw system, and the Cities of Moose Jaw and Regina, together with associated rural loads. The compilation was based on 1949 consumptions and has been extended for urban centres, as well as the rural electrification program, which by 1969 will include approximately

75,000 farms. It may be noted that the actual consumptions for 1950 and 1951 in the Saskatchewan Power Corporation system, (which does not serve the Cities of Moose Jaw and Regina) lie on the projected curve.

The consumption for this adjacent area in 1964 is estimated to be approximately 1,100,000,000 Kw. Hrs. This consumption is the bulk energy delivered to the distribution system in the case of cities, and to the consumer meters in towns, villages, hamlets and rural areas. The addition of system losses increased the required generation by some 20% or to 1,350,000,000 Kw. Hrs. annually.

If the completion date for the Central Saskatchewan Development is assumed to be not earlier than 1964, the required generation in the contiguous area will be approximately 1,350,000,000 Kw. Hrs. or four times the estimate of 325,000,000 Kw. Hrs. of firm output for the project. The Moose Jaw-Regina area alone could absorb the available output.

5. The Need for Increased Food Output in Canada

A major economic and social contribution flowing from the proposed development of the Central Saskatchewan Development will be the significant increase in the production of food and foodstuffs made possible by bringing the lands under irrigation. Output on the 430,000 acres contained within the project area will be increased three or even four-fold. Saskatchewan, however, is already well established as an important surplus producer of certain basic foodstuffs. Hence the potential expansion in output might be regarded as of doubtful economic significance, were it not for the fact that present and future requirements for food at provincial, national and even international levels are likely to absorb the whole of the anticipated increased production. Existing trends suggest more strongly and the continued rising demand for foodstuffs, and particularly for animal products, will provide economic and accessible markets for the full output of the developed project.

The demand for food is based primarily on two major factors,—population and income. The former will indicate total expected consumption determined most realistically by existing patterns of consumption. The latter is closely related to the qualitative aspects of consumption, that is, the kinds of food people eat. In addition to these basic factors are such other influences as international policies, national trade policy, industrialization and urbanization, age distribution, nutritive standards, and so forth. It is not proposed to examine all these ramifications, but rather to consider markets in Canada chiefly from the point of view of future population.

(i) THE FUTURE CANADIAN FOOD MARKET

Beyond the boundaries of Saskatchewan itself lies a rapidly-growing and accessible market for all manner of foodstuffs. In terms of demands resulting from increased population, the Dominion Bureau of Statistics has projected forecasts of future population size based on data up to the 1941 census.⁴ The Bureau's most realistic estimate suggested a Canadian population of approximately thirteen millions by 1951 and fifteen and a half millions by 2001. It is quite obvious from the 1951 Census that a significant error in growth rates had been made since the total Canadian population in 1951 was over fourteen millions. It would seem that the entire trend should be revised, on the basis of a higher fertility rate, to forecast a considerably larger population by 1970 or 2000.

It is of interest to note that similar and even more serious errors in population forecasting were experienced in the United States. These are reported in an article by Professor Joseph S. Davis of Stanford University, dealing with future demands for food.⁵

"Ten months ago the standing official forecast for 1970 was, in round figures, 160 million, and this was the figure commonly used by economists. Six months ago, the revised official forecast indicated that this figure would be reached in 1960. Evidence now available strongly suggests that our true population will reach 160 million during 1955, if not earlier."

Professor Davis relates this unexpected population increase to food needs and asserts that projected food demands should be revised upwards. He declares: "in conjunction with our higher consumption standards, I believe that our demand for milk, meat and other animal products will become such as to put pressure upon our ability to expand the output of these products."

On the basis of developments in Canada and the United States, it would appear reasonable to expect a Canadian population approaching 20 million between 1975 and 2000.

This projection is by no means liberal in view of the statement of Mr. St. Laurent in the House of Commons, recently (Hansard, June 28, 1952, p. 3946). The Prime Minister stated at that time: "This means that at the end of the century there will be no less than 35 million people for whom the country will have to provide agricultural sustenance."

What does this mean in terms of actual food and acreage requirements? An estimate has been prepared

based on the assumption that current levels of per capita consumption of various foods will be maintained and that relative levels of imports and exports will remain constant. The details are contained in Annex I and only a few figures are quoted here. The following table lists estimated additional acreage requirements to feed a Canadian population of twenty millions.

TABLE 4—Additional Acreage Requirements to Feed a Canadian Population of Twenty Millions

Food	Additional Acreage Requirement (⁰⁰⁰ acres)*
Butter	2,260
Beef and veal	3,655
Pork	1,500
Fluid Milk	2,377
Sugar beets	30
Dry beans and peas	60
Total	9,882

It is quite obvious from this list that either new agricultural land will be needed or more intensive use of present acreage instituted if we are to feed a population of 20 millions without major reliance on imports for many of our foods. The former possibility does not appear to offer significant opportunities. The era of expanding agricultural acreage experienced on this continent from 1900 to 1930 is now over. Only small areas still await development. Mechanization has already freed large acreages for production of food, but no comparable physical or technological frontier can be foreseen. Canada will thus have to rely on more intensive use of soil resources in the future in order to meet growing requirements for food.

(ii) SUMMARY

In summary, anticipated population changes in the next twenty-five or thirty years strongly suggest much larger food requirements on the part of the Canadian people. This rising demand can only be met by a significant expansion in total food production and a relatively larger output of meat, milk, vegetables and fruit products, if exports and imports of these particular foodstuffs are to be maintained at present levels.

There is, moreover, a considerable weight of evidence to suggest that the demands for exports of food from Canada is likely to increase at a rate comparable to that within the country. Growing

⁴ Dominion Bureau of Statistics, *The Future Population of Canada*, Bulletin F-4, 1949.

⁵ Joseph S. Davis, "Our Amazing Population Upsurge", *Journal of Farm Economics*, November, 1949.

populations and limited soil resources have made self-evident the basic necessity for increasing total world food output. It is not proposed here to attempt to appraise the economic effectiveness of rising world food demands, since it is contended that the entire increased output of the Central Saskatchewan Development will be absorbed by domestic food requirements. At the same time, the vastly greater needs of the world at large give still greater importance to the potential returns from this major irrigation project.

6. National Benefits

Up to this point in the submission the need for the Central Saskatchewan Development, together with its potential contribution in terms of increased agricultural stability and security, food supply, hydro-electric power, recreational facilities, municipal water supply, flood control and industrial development, have been discussed. It remains to associate this development with the national economy. I propose to do this in two ways. Firstly, the actual contribution to national output will be measured and, secondly, the place of this investment in a national policy will be discussed.

(i) INCREASES IN NATIONAL OUTPUT RELATED TO THE CENTRAL SASKATCHEWAN DEVELOPMENT

In the Interim Statement by my Government to the Commission "benefits" were estimated on a basis of direct returns to the irrigation farmer or to power. While this measure is a useful one, in terms of planning individual farm organization and determining repayment ability of irrigation farmers, or in planning power organization and determining its repayment ability, it does not indicate the total impact of increased production on national income. To do this, as is done in measuring national output it is necessary to follow each product through its marketing and processing stages where value is added throughout, arriving finally at the value of the product at the final consumption level. This technique has been applied here. Certain assumptions have been made in order to justify its use and these are contained in Annex II.

(a) *Increases Related to Agricultural Production.*—In general, additions to national output are measured here by adding the margin between farm and consumer to the farm price. This has been done for six products, wheat, oats, barley, hay, cattle and sugar beets. A composite output for the project as a whole is derived from the average production figures indicated in the alternative types of farm organization presented in Part II.

The following table summarizes the expected contributions to national output from the Central Saskatchewan Development.

TABLE 5—*Gross Annual Agricultural Contributions of the Development to National Output*

Product	Value	
	Initial Development	Mature Development
	\$	\$
Wheat.....	5,370,000	4,350,000
Barley.....	1,434,375	1,636,875
Oats.....	679,000	742,500
Hay.....	1,188,000	2,160,000
Cattle.....	32,400,000	32,400,000
Sugar beets.....		16,174,080
	41,071,375	57,463,455

This, of course, is a gross contribution since the existing farm in the area are at present producing income. It is necessary to estimate the value of this production under assumptions used above.

TABLE 6—*Present Annual Agricultural Contribution of the Project Area to National Output*

Product	Value
	\$
Wheat	3,580,000
Barley	403,200
Oats	696,018
Livestock	2,241,000
	6,920,218

The net contribution of the project in terms of agricultural products is obtained by taking the difference between the values under irrigation and under present dry land practices. At initial development the net contribution is \$34,151,157 annually; at mature development the net contribution is \$50,543,237 annually.

There are, in addition, other contributions stemming from intensified agricultural production in the area. Not only will increased production of agricultural products from the Development increase national output but increased demand of irrigation farmers for goods and services will also have a considerable effect. Each new farmer will spend about \$4,500 annually for goods and services, (see Part II). For the 1,455

new farms this totals approximately \$6,500,000 added to national output annually. In addition, the existing farm population will increase its expenditure because of more intensive production. In all, about \$10,000,000 will be added annually to national output.

* * * *

Thus, it may be anticipated that agricultural development on the project will result in the addition of from \$44 to \$67.5 millions annually to national output. That this contribution will be widespread is implicit in the above estimate. Food processing, transportation, implement, fertilizer, and marketing establishments and many others will all feel the impact of these dollars. Tax collections at all levels of government will increase as a direct consequence.

(b) *Increases Related to Power Production.*—This contribution is measured by applying retail prices of power to the expected output from the Coteau Dam. The annual report of the Saskatchewan Power Corporation indicates that the value of power sold in 1951 was approximately three cents per kilowatt hour. Since the output of firm power from the Coteau Creek installation is expected to be 325 million kw. hrs. annually, this output, at present prices, is worth almost \$10 million. This estimate could be extended to include other hydro-electric power made available as a result of the Coteau Dam.

Availability of power will, at the same time, stimulate a great demand for electrical appliances of various kinds and, undoubtedly, the annual investment in these items will be far greater than the annual value of power. It is estimated, for instance, that investment in domestic appliances on an electrified farm approximates \$1,500 today. Added to this is the value of numerous pieces of electrical equipment used in farm production. It is apparent, therefore, that the provision of power will have far-reaching effects on the national economy.

(c) *Summary.*—It may be expected that production of food and power and increased demand for goods and services arising from the Development will add from \$54 to \$77.5 millions to national output annually. This estimate cannot be considered extravagant in view of a number of related contributions which were not evaluated. It is of cardinal importance to note the national impact of this investment. One could note the industries, areas, and people affected for many pages—without exhausting the list. It is also of importance to

note that if the total investment of \$100 millions is spread over the lifetime of the project it is a very small fraction of the anticipated annual contributions to national output. Two essential criteria are thus satisfied. Firstly, the national impact of this investment in Saskatchewan is marked and widespread. Secondly, the investment is a paying proposition.

Can Canada afford to incur the substantial losses to her economy implied in failure to proceed with the project?

(ii) THE CENTRAL SASKATCHEWAN DEVELOPMENT AND NATIONAL POLICY

Having definitely established the feasibility of the Development in engineering and agronomic terms, in terms of provincial and national economic value, in terms of provincial agricultural stability and economic security and in general provincial social terms, there remains the question of the relationship of this project to national policy.

What should this relationship be? It is submitted here that national benefits mean not only dollar returns to the nation from a national investment but social and political returns in terms of national policy and national interest. It is insufficient to argue that national interest in the redistribution of income or in the creation of equal opportunities lies wholly within the field of welfare programs. Equal opportunity in resource development must become a principle of equal force. It is within the context of this principle that we argue for construction of the Central Saskatchewan Development.

It is submitted here that Saskatchewan has been largely by-passed in federal resource development programs since the early days of its settlement despite its wealth of undeveloped resources and actual known projects awaiting development. Reference might be made here to federal investment in the various provinces. This neglect has not escaped public notice. In fact, it might be well to quote the thoughts of Mr. St. Laurent:

"This third project was the South Saskatchewan River Project. This is of particular interest to the central provinces, but it is also of interest to the whole of Canada to have Canada developed in such a manner that there will be no depressed areas in this country.

These three projects (St. Lawrence Seaway, Canso Causeway and South Saskatchewan River Project) appear to fill out the picture, because we

know what huge developments are taking place in British Columbia; we know what huge developments are taking place in Alberta; we know what developments are in prospect in northern Manitoba for the promotion of which authority was given at the last session of parliament to the Canadian National Railways to construct a line of railway. I think all members of this house realize that these projects, though located in particular areas, are of national importance if they are sound and if we can get evidence reasonable men will accept that they constitute a proper investment of the capital of this country." (*Hansard*, June 28, 1952, p. 3945).

Construction of the Central Saskatchewan Development will serve to strengthen and unify our nation. Certain investments of this nature have been made in Saskatchewan in the past and have made valuable contributions to the province and nation but much more must be done if Saskatchewan is to be considered a full partner in a national development policy. Support for the project as a national responsibility is in evidence throughout Canada. No other single project in recent Canadian history has received such consistent and unqualified public support from both western and eastern Canada.

The Federal Government recognizing the national merits of the scheme has already made its commitment. In the same address noted above Mr. St. Laurent stated:

"I hope this Commission will find that the South Saskatchewan project would constitute a proper investment of the amount of capital required to bring it into existence. If it does there will be a commitment by this government, and I am sure there would be a commitment by any government in office, to carry out the project provided there are satisfactory reports...."

* * *

In conclusion, I wish to stress that Saskatchewan has only two rivers as a source of extensive irrigation and power development; the most important being the South Saskatchewan. The people of Saskatchewan have looked hopefully for many years towards the construc-

tion of the Central Saskatchewan Development. We trust that this hope will not be turned to despair. Construction of this great project will provide a tremendous boost to the morale of Saskatchewan people. The people of this province have contributed greatly to the national wealth of Canada and have an undeniable right to an equitable share in the development of our great water resources. They have also experienced great hardship and despair because of the natural and economic handicaps imposed upon them. They have a legitimate right to expect that our national government will recognize these facts and proceed with this long awaited development.

The people of this province are weary of being relegated an inferior position and subjected to criticism for being subsidized by relief measures because of conditions beyond their control. You may be assured that this province will be forever grateful for the benefits made possible by the construction of this project. You may also be assured that nothing else will do more towards renewing confidence in confederation and nationhood on the part of the people of Saskatchewan.

The Government of Saskatchewan urges the Commission to recommend immediate construction of the Central Saskatchewan Development.

Annex I

ESTIMATE OF FOOD AND ACREAGE REQUIREMENTS OF A CANADIAN POPULATION OF TWENTY MILLIONS

The estimated food requirements of a Canadian population of twenty millions are contained in Table 7, together with an estimated deficit based on present production. It is assumed here:

- (1) that the food consumption pattern will be maintained (This probably biases the emphasis in favor of "non-protective foods");
- (2) that import levels will not change;
- (3) that 1949-50 production levels of the various foods are typical.

TABLE 7—Estimated Supply and Requirements of Food in Canada

Food Groups	Available from Domestic Production, 1949	Per Capita Consumption 1949	Indicated Total Food Requirements Basis 1949 Consumption 13,549,000 Population	Indicated Total Food Requirements Basis 20,000,000 Population	Surplus (+) or Deficit (—) of Supplies Over Domestic Consumption 20,000,000 Population
		lbs.	000,000 lbs.	000,000 lbs.	000,000 lbs.
1. <i>Flour and Cereals</i>	15,738 million lbs. (in terms of flour).....	167.7	2,260	3,354	+12,384
2. <i>Potatoes</i>	5,352 million lbs.....	211.5	2,866	4,230	+ 1,122
3. <i>Dry Beans and Peas</i>	212 million lbs.....	13.6	184	272	— 60
4. <i>Fruit</i> (citrus and tomatoes, etc. fresh, canned, and frozen).....	1,146 million lbs.....	177.4	2,404	3,548	—2,402
5. <i>Vegetables</i> (fresh, canned and frozen).....	1,560 million lbs.....	80.5	1,091	1,610	— 50
6. <i>Oils and Fats</i>					
(a) Lard.....	110 million lbs.....	8.1	123	182	— 72
(b) Butter.....	320 million lbs.....	23.5	326	470	— 150
7. <i>Meat</i>					
(a) Meat					
i. Beef.....	867 million lbs.....	56.5	766	1,130	— 263
ii. Veal.....	124 million lbs.....	9.1	123	182	— 58
iii. Mutton and Lamb.....	44 million lbs.....	3.0	41	60	— 16
iv. Pork.....	911 million lbs.....	59.2	803	1,184	— 273
v. Canned Meats and Edible Offals.....	132 million lbs.....	9.4	127	188	— 54
8. <i>Poultry</i>	292 million lbs.....	21.2	287	424	— 132
9. <i>Eggs</i>	334 million doz. or 459 million lbs.....	33.5	453	670	— 211
10. <i>Milk</i> (or its equivalent).....	6,476 million lbs.....	474.7	6,476	9,494	—3,018
11. <i>Sugar and Syrups</i>					
(a) Sugar Beets.....	291 million lbs. of sugar equivalent when manu- factured.....	15.4	208	308	— 100
(b) Honey.....	31 million lbs.....	2.4	32	48	— 14
(c) Maple Sugar and Syrup.....	23 million lbs.....	1.0	13	20	— 3

Having estimated food deficiencies it is now necessary to translate these into acreage requirements.

ADDITIONAL ACREAGE REQUIRED TO MEET FOOD REQUIREMENTS ASSUMING A POPULATION OF 20 MILLION IN CANADA

1. *Flour and Cereals*—No additional acreage requirements.
2. *Potatoes*—No additional acreage requirements.
3. *Dry Beans and Peas*—The long time average yield per acre of peas and beans in Canada is 17 bushels to the acre. This would indicate that an increase of some 60,000 acres would be required.
4. *Fruit*—Fruit acreages for Canadian crops are not available. However, judging by the huge deficit in supplies over domestic requirements at 20

million population, it might be concluded that the acreage required would approximate three times the present acreage devoted to fruit crop production in Canada.

5. *Vegetables*—The average yield per acre of vegetables in 1950 was 12,470 lbs. Applying this figure to the deficit of 50 million pounds on the assumption of the increase in population, it is estimated that an additional 4,000 acres would be required.
6. *Oils and Fats*—The butter deficit indicated is 150 million pounds or converted to pounds of milk some 3,500 million lbs. of milk equivalent. With an average production of 5,000 lbs. of milk per cow, some 700,000 additional dairy cows would be required. To feed these additional cows would require at average yields,

about 1,750,000 acres of pasture, about 260,000 acres of grain, 75,000 acres of corn for silage and 175,000 acres of hay.

This added production of butter would still only compensate for half of the incipient deficiency in the supply of oils and fats in Canada on the assumption of a 20 million population.

7. Meat—

(i) *Beef and Veal Requirements*—The increase in the production of beef to provide the additional quantities required to feed a population of 20,000,000 would be about 265,000,000 lbs. of beef and 60,000,000 lbs. of veal. During 1951 the average carcass weight of inspected slaughtered beef was 507 lbs. and that of veal was 122 lbs. This would mean that to produce this additional quantity of beef and veal would require an additional 520,000 head of cattle and 475,000 calves, or a total of 975,000 cattle and calves. To feed these additional cattle and calves would require at average yields and in round figures about 2,440,000 acres of pasture, 730,000 acres of grain and 485,000 acres of hay.

(ii) *Pork Requirements*—The deficit in pork supplies over requirements were the population to increase to the 20 million level would be approximately 275,000,000 lbs. With an average dressed weight of 163 lbs. per hog, required additional increase would be equivalent to an increased production of 1,680,000 hogs.

Assuming a production of 1,200 lbs. of grain per acre sufficient to feed 1.12 live hogs the total grain acreage required to feed 1,680,000 hogs would be approximately 1,500,000 acres. No allowance has been made for the additional acreage requirements to meet the deficiencies in the production of canned meats and mutton and lamb.

8. *Poultry*—The increase in acreage required for poultry is quite difficult to estimate. The deficiency in anticipated supplies over requirements is roughly 45% of 1950 production.

9. *Eggs*—Egg production would be required to increase by almost 50 per cent to make up anticipated deficiencies at the assumed population level of 20 million.

10. *Milk*—The increase in the production of milk to provide the additional quantities of fluid milk or its equivalent required to offset the requirements of a population increase would be more than 3,000,000 lbs. annually. With an average production of 5,000 lbs. per cow, some 600,000 additional dairy cows would be required. The feed for these additional cows would require at average yields, about 1,500,000 acres of pasture, about 450,000 acres of grain, 127,000 acres of corn for silage and 300,000 acres of hay.

11. *Sugar Beets*—It would be necessary to increase present sugar beet production in order to make up an anticipated deficiency in sugar production over requirements of 100,000,000 lbs. or 590,000,000 lbs. of sugar beets. The long time average yield per acre of sugar beets in Canada is some 19,200 lbs. Thus, the required additional acreage of sugar beets would be approximately 30,000 acres.

NOTE:—The estimates on additional acreage requirements for beef, pork, milk, and butter deficiencies are projected from calculations made by W. C. Hopper, "Food Consumption in Post-War Canada," *C.S.T.A. Review*, March, 1945 (Canadian Society of Technical Agriculturists, Inc.), Ottawa, pp. 26-35.

TABLE 8—Summary of Additional Food and Acreage Requirements

Food	Additional Requirement	Acreage Requirement
	million lbs.	thousand acres
Dry beans and peas.....	60	60
Fruit.....	2,402	no estimate
Vegetables.....	50	4
Lard.....	72	no estimate
Butter.....	150	2,260
• Beef and veal.....	321	3,655
Mutton and lamb.....	16	no estimate
Pork.....	273	1,500
Canned meats and edible offals.....	54	no estimate
Poultry meats.....	132	no estimate
Eggs.....	211	no estimate
Milk.....	3,018	2,377
Sugar beets.....	100	30
Honey.....	14	no estimate
Maple sugar and syrup.....	3	no estimate
Total.....		9,886

Annex II

ASSUMPTIONS UNDERLYING THE CALCULATION OF INCREASES IN NATIONAL OUTPUT STEMMING FROM AGRICULTURAL PRODUCTION OF THE CENTRAL SASKATCHEWAN DEVELOPMENT

In the Interim Statement "agricultural benefits" were estimated on a basis of direct returns to the irrigation farmer. While this measure is a useful one it does not indicate the total impact of the increased agricultural production of the project on national income. To do this it is necessary to follow each product through its marketing and processing stages where value is added throughout, arriving finally at the value of the consumption level which represents a component of national output.

In order to apply this technique it is necessary to make certain assumptions. First, it must be assumed that sufficient effective demand for the products exists. This is established in the submission. Secondly, it must be assumed that sufficient capacity exists in the economy so that the new production from the project generated by demand and supply conditions is not merely "substituting" for other types of production. For instance, in a completely and strictly fully-employed economy additions to national income would not be possible since it would be necessary to transfer already fully-employed resources if additional production were to be introduced. It will be demonstrated, however, that this condition does not obtain and, in fact, processing and marketing facilities in existence at present have considerable excess capacity (see Addendum). Furthermore, expected population increase will form the basis, not only for a demand for food but also an adequate labor supply. The general assumption adopted here is that the increased production that is over and above present primary and secondary production can be assumed an addition to national income.

Thirdly, it is necessary to assume that the production, marketing and processing of foods is the best way to utilize the resources involved and in any case that net addition to national output is the difference between the suggested and the *next best* use of the resource. If it is assumed that effective demand for food will exist, then the only alternative to increasing Canadian food production is to import food. Taken by itself, this alternative does not appear promising since the type of foods which the Development will produce is not available in the world market at reasonable price levels. Furthermore, there appear to be some necessity for assured national food production in the world today. Despite these general arguments it is still necessary to establish

some differential between the alternatives in resource use, simply because there are real alternatives available at certain price levels. Unfortunately, the means for doing this are not available and any arbitrary application cannot be justified. A differential can actually be established in the primary phase of production, that is, the difference in output between present dry land and future irrigation output of the resources involved. The same kind of differential is applied in secondary production with the assumption that the resources employed today will be operating more efficiently on the basis of increased volume.

With these basic assumptions in mind, it is possible to proceed with the task of estimating the additions to national output generated on the one hand by demand requirements and on the other by production resulting from the Development. This is done in Part II of these submissions.

Addendum

CAPACITY OF FLOUR MILLING AND MEAT PACKING INDUSTRIES IN CANADA

(a) *The Flour Milling Industry*.—In the *Report on the Grain Trade of Canada, 1948-49*, a joint publication of the Dominion Bureau of Statistics and the Board of Grain Commissioners, it is stated that in 1949 the percentage of milling capacity utilized by the flour milling industry of Canada averaged only 67.3 per cent.

(b) *The Meat Packing Industry*.—No similar figure is available as to the rated capacity of the meat packing industry in Canada. However, present indications are that the industry as a whole is operating well under its full capacity potentialities. The Dominion Bureau of Statistics, *Report on the Slaughtering and Meat Packing Industry 1950*, shows a considerable reduction in the number of animals slaughtered in the meat packing industry in 1950 as compared with 1944, when it is assumed the industry was operating at or near full capacity. The number of cattle slaughterings show a drop of 8.37 per cent, sheep and lambs show a reduction of 46.7 per cent, while hogs declined by 47.3 per cent. The overall decrease in the number of animals slaughtered in 1950 as compared with 1944 was approximately 40 per cent.

Much the same conclusion is reached in a publication entitled "*Livestock Marketing in Western Canada*" which was published by the Saskatchewan Department of Co-operation and Co-operative Development in co-operation with the Economics Division of the Federal

Department of Agriculture. On page 80 of the Report attention is drawn to the problem of estimating the capacity of the meat packing industry. The Report gives the following information:

"Some idea of the relationship of recent slaughtering to plant capacity as judged by highest

monthly slaughter during the heavy wartime runs may be seen by an examination (of the following table) which compares numbers of livestock processed in each of the western provinces of the peak months of 1949 with numbers processed in the peak months during the war.

Inspected Slaughtering of Cattle, Calves, Hogs and Sheep in Western Provinces, Highest Month in 1949 Compared with Highest Month During the War Years

(Number of Head)

	Cattle		Calves	
	1949	Demonstrated Capacity	1949	Demonstrated Capacity
Manitoba.....	43,030 (Nov.)	71,148 (Nov. '45)	16,697 (Sept.)	17,634 (June '45)
Saskatchewan.....	11,643 (Oct.)	24,423 (Nov. '45)	3,423 (Sept.)	4,055 (Aug. '45)
Alberta.....	24,510 (Nov.)	46,561 (Nov. '45)	9,303 (Sept.)	9,673 (July '45)
British Columbia.....	11,310 (Nov.)	15,513 (Nov. '45)	4,654 (Oct.)	3,444 (Nov. '45)
	Hogs		Sheep and Lambs	
	1949	Demonstrated Capacity	1949	Demonstrated Capacity
Manitoba.....	75,940 (Nov.)	239,269 (Dec. '43)	16,786 (Oct.)	64,270 (Nov. '45)
Saskatchewan.....	39,994 (Dec.)	134,613 (Dec. '43)	3,014 (Oct.)	9,951 (Nov. '45)
Alberta.....	98,335 (Dec.)	247,585 (Mar. '44)	10,092 (Oct.)	17,551 (Nov. '45)
British Columbia.....	27,105 (Nov.)	24,514 (May '45)	10,061 (Oct.)	16,270 (Oct. '45)

In view of the foregoing information, it would be fair to conclude that the meat packing industry today is operating at much less than full capacity.

PART II

September 11, 1952.

Dr. T. H. Hogg,
Chairman, Royal Commission on
the South Saskatchewan River Project,
406 Elgin Building,
Ottawa, Canada.

Dear Sir:

I have the honour to present a submission to your Commission from the Plant Industry Branch of the Saskatchewan Department of Agriculture.

This submission deals with the potentialities of crop production on the Central Saskatchewan River Project. I trust it will be helpful in the deliberation of the Commission.

Yours very truly,

R. E. McKENZIE,
Director, Plant Industry Branch.

AGRICULTURAL POTENTIAL OF THE CENTRAL SASKATCHEWAN DEVELOPMENT

The fundamental problem of agriculture over the open plains region of Saskatchewan is drought. The history of farming in this province during the past 50 years shows clearly the unstable nature of production. This history is marked with the records of recurring droughts, crop failures, lack of feed reserves for livestock and the expenditure of many millions of dollars for agricultural aid.

One of the solutions to drought and resulting agricultural instability is irrigation development. By building a dam, as proposed at the Coteau site on the Central Saskatchewan River, it will be possible to command nearly half a million acres for irrigation. The best engineering advice available indicates that it is entirely feasible to construct such a dam. It has been stressed that the building of this dam would produce many important benefits. Electric power would be developed for rural electrification and industrial use, stream flow would be regulated, recreational facilities would be provided and municipal water supplies would be improved. However, the most important reason for constructing the dam is to bring water to some half million acres of farming land now subject to drought and in that way to rehabilitate the agricultural of this area as well as surrounding dry land area and thus give greater stability to the whole agricultural economy of Saskatchewan. This brief proposes to show very clearly that the Central Saskatchewan Development is sound from an agricultural standpoint, that it is essential to future Canadian and world food needs and that high production and returns will be obtained.

1. Agronomic Aspects

The basis of successful irrigation farming in any area is suitable soil types, desirable topography, good water supply and an arid climate with a comparatively long frost-free season.

Approximately 430,000 irrigable acres in the proposed development area have been classified in the three top grades according to suitability for irrigation. A high proportion of these soils are lighter textured and represent the most desirable types from the standpoint of applying water. They will take water readily, provide good sub-surface drainage and are practically free from alkali salts. From a fertility standpoint the soils can be regarded as equal to that of similar soil types in any other irrigated area of Western Canada.

Topographic features of the development area are very favourable to irrigation. The absence of steep slopes or very flat areas and the existing opportunities for natural drainage are all factors which will allow water to be applied efficiently without the danger of waterlogging the soil or the formation of a high water table.

From the standpoint of soils and topography, it cannot be denied that the proposed development area rates very highly. These extremely favourable soil and topographic conditions are a striking contrast to other irrigation projects developed to date in Saskatchewan which have had to be confined principally

to low-lying areas of heavy textured soils containing moderate to heavy concentrations of soluble salts. These soils have presented obvious problems. The proposed Central Saskatchewan River Development is an entirely different picture. Here, for the first time on a large scale, it will be possible to develop irrigation on upland soils of good texture, fertility and topography. There can be no doubt but what high production a permanent type of irrigation agriculture will develop in the area.

With respect to climate, available data have been shown that the mean annual precipitation is too low for anything more than a subsistence type of dryland agriculture. On the other hand, experience has shown that the drier the area, the more highly developed irrigation farming becomes. Planned irrigation practices develop and the farmers count less on rainfall as a factor in crop production.

The mean temperatures and the length of the frost-free period prevailing in the area indicates that much the same kinds of crops as are grown in the irrigated districts of Southern Alberta can be produced in Saskatchewan.

With regard to water supply, studies and records show that there is sufficient available to meet the requirements for a full duty of water on the project.

Thus from an agronomic standpoint, the soil, topographic, climatic and water supply features of the project are equal or superior to any other project yet developed in Western Canada. There is every reason to believe that high crop production will occur and this assumption is being borne out by preliminary results obtained on the Experimental Area on the Pre-Development Farm at Outlook.

2. Agricultural Development

When land is brought under irrigation on the project and during the first few years of settlement annual crops such as coarse grasses will be grown principally. However, once the land is levelled and ditches properly located, a cropping program based on sound rotational and fertility principles, along with the efficient use of water, will be required to achieve high production and develop a permanent type of agriculture. This will be accomplished in a relatively short time, much sooner than has been the case on older projects. Today, there is an immense fund of knowledge based upon experience, research and experimentation available to the new irrigation farmer. In addition we have the benefit of experience on older projects to assist in avoiding mistakes which have been made in the past and in expediting proper development. Furthermore, considerable experimental data from the work being conducted by

Experimental Farms Service at Outlook, as well as the results from a large-scale, well-planned, practical farm rotation being carried on by the P.F.R.A.'s Pre-Development Farm at Outlook will be available as a guide and demonstration for new settlers. By the time the project comes into operation there will be more sound, practical information available for new irrigation farmers than on any other project developed in Western Canada to date. This fact is one of the most significant but perhaps overlooked features of agricultural development on the Central Saskatchewan project. Coupled with a sound extension program which will be instituted by the Saskatchewan Department of Agriculture, it means that individual farm cropping programs, aimed at realizing and maintaining high production, will be developed in a very short time.

Experience in other irrigated areas has demonstrated clearly that straight grain production cannot be carried on under irrigation at a profitable level. The need for rotations which include forage crops along with the use of fertilizers and manure is essential for maximum production. In a proper rotation in this area a minimum of 50 per cent of the acreage should be devoted to perennial forage crops for hay, pasture or seed production and the remainder used for annual crops such as cereals and the various specialty crops. In the early years of development a forage-cereal, crop-livestock economy is visualized. In later stages some cereal crop production would be replaced by specialty crops such as sugar beets, potatoes and peas, beans and corn for canning.

A new and rapidly developing feature of irrigation farming is the use of seeded pastures. Evidence to date indicates that irrigated pastures can give returns comparable to any known specialty crop. In Washington, irrigated pastures have produced nearly 1,000 pounds of beef per acre. In Utah, dairy cattle have given gross returns on irrigated pasture of over \$200 per acre. In Southern Alberta, the use of irrigated pastures is fast developing as a profitable enterprise for beef and dairy cattle and for sheep. At the Swift Current Experimental Station irrigated pastures carry 11 head of mature sheep per acre, compared to one head for 6 acres on native pastures. In the development area irrigated pastures will undoubtedly assume an important place and will in effect be a specialty crop.

We believe the agricultural development of the Central Saskatchewan area will be based on a livestock economy. Various types of livestock enterprises can be carried on such as (1) farm beef herd (2) the purchase of calves or yearlings in the fall for winter feeding and spring sale, or for winter feeding and summer pasturing

for fall sale (3) dairy herds for fluid milk or cream production (4) farm flocks of sheep (5) hog production, particularly in conjunction with dairying.

3. *Expected Production and Returns from a Typical Irrigated Farm in the Central Saskatchewan River Development*

In order to establish what the project will contribute to the national economy in terms of production and revenue, it is proposed to examine the returns which can be expected from a typical irrigated farm in the development area. A typical farm is envisaged as being 160 acres in size of which 144 acres are available for crop production after making allowances for the farmstead, non-irrigable portions and loss from ditches. Two stages of development will be projected, the first being based on a livestock, cereal grain economy and applicable to the initial development stage; the second based on livestock, cereal grain and specialty crop production and applicable to the mature development stage.

At both stages a minimum of 50 per cent of the acreage in forage crops and 50 per cent in annual crops is assumed. These crops are grown in a systematic rotation which includes regular application of fertilizers and manure to maintain fertility.

The livestock enterprise is illustrated in two ways (A) a farm beef herd is maintained (B) calves are bought in the fall, wintered on the farm, and pastured during summer and sold in the fall.

Yield levels assumed envisage good operation and management but are short of the maximum which could be obtained.

The price levels forecast are less than current prices and, based on expected future world food requirements, are considered to be most conservative.

(1) ORGANIZATION, PRODUCTION AND COSTS OF A TYPICAL LIVESTOCK-CEREAL CROP FARM, CENTRAL SASKATCHEWAN RIVER PROJECT—INITIAL DEVELOPMENT STAGE

Cropping Program.—A 160 acre farm is selected as an average sized unit. On this farm 144 acres are available for cropping. This acreage is divided into 12 fields of 12 acres each for rotation purposes. The remaining 16 acres are taken up by the farmstead, non-irrigable portions and loss through ditches.

Livestock Program.—Two examples of livestock enterprises are used. In the (A) enterprise a herd of 26 beef cows is maintained, 23 calves are wintered each year 21 yearlings are sold each year in the fall. All cattle are pastured entirely on the farm.

In the (B) enterprise 70 head of beef calves are purchased in the fall, fed during winter and pastured on the farm in the summer. These are sold in the fall. Sales are based on 67 head, allowing for a mortality of 3 head.

(A) CROPPING PROGRAM, YIELDS AND PRODUCTION

Crop	Fields	Yields/acre	Total Production
Hay.....	3(36 acres)	2.5 tons	90 tons
Wheat.....	3(36 acres)	35 bu.	1,260 bu.
Oats.....	1(12 acres)	80 bu.	960 bu.
Barley.....	2(24 acres)	50 bu.	1,200 bu.
Pasture.....	3(36 acres)	2 head carrying capacity	

Hay and Grain Consumed by Livestock

Livestock Enterprise (A)

Hay—65 tons (surplus 25 tons)
Oats—295 bus. (surplus 640 bus. excluding seed)
Barley—295 bus. (surplus 855 bus. excluding seed)

Livestock Enterprise (B)

Hay—70 tons (surplus 20 tons)
Oats—960 bus. fed on the farm and used for seed
Barley—1200 bus. fed on the farm and used for seed

(B) INCOME AND EXPENDITURE SUMMARY

Income

Livestock Enterprise (A)	—	Livestock Enterprise (B)
\$		\$
1,375 00	Wheat—1,100 bus. @ \$1.25	1,375 00
769 50	Barley—855 bus. @ 90c.....	
320 00	Oats—640 bus. @ 50c.....	
500 00	Hay—25 tons @ \$20.00.....	
	20 tons @ \$20.00.....	400 00
3,024 00	Cattle—(A) 21 x 900 @ 16c.....	
	(B) 67 x 900 @ 16c.....	9,648 00
Total 5,988 50		11,423 00

Expenditures

Livestock Enterprise (A)		Livestock Enterprise (B)
\$ cts.		\$ cts.
1,350 00	Total machinery cost—15% of \$9,000.....	1,350 00
300 00	Gas, oil and grease.....	300 00
100 00	Taxes.....	100 00
800 00	Hired Labour.....	800 00
350 00	Threshing.....	350 00
350 00	Buildings, fences etc. 7% of \$5,000.....	350 00
80 00	Fertilizer.....	80 00
156 00	Servicing costs.....	
300 00	Miscellaneous supplies.....	300 00
	Purchase of calves 325 lbs. x 18c. x 70.....	4,095 00
3,786 00		7,725 00
2,202 50	Gross returns.....	3,698 00
1,000 00	Living costs.....	1,000 00
1,202 50	Return to Irrigation.....	2,698 00
7 52	Per Acre Return to Irrigation....	16 86

(ii) ORGANIZATION, PRODUCTION AND COSTS OF A TYPICAL LIVESTOCK AND SPECIALTY CROP FARM—CENTRAL SASKATCHEWAN RIVER PROJECT—MATURE DEVELOPMENT STAGE.

Cropping Program—The same sized farm unit as was selected for the initial development stage will be used in this budget estimate. The rotation is the same with the exception that one field of wheat is replaced by 12 acres devoted to a specialty crop. For the purpose of illustration, sugar beets are selected although the specialty crop could conceivably be potatoes, peas, beans or corn.

Livestock Program—Returns are based on the same two types of livestock enterprises used for the initial development stage.

(A) CROPPING PROGRAM, YIELDS AND PRODUCTION

Crop	Fields	Yields/acre*	Total Production
Hay.....	3(36 acres)	3.0 tons	108 tons
Wheat.....	2(24 acres)	40 bus.	960 bus.
Oats.....	1(12 acres)	85 bus.	1,020 bus.
Barley.....	2(24 acres)	55 bus.	1,320 bus.
Sugar beets.....	1(12 acres)	13 tons	156 tons
Pasture.....	3(36 acres)	2 head carrying capacity	

* A slightly higher level of yields is assumed in the mature development because of previous rotation of crops and continued use of manure and fertilizer over a period of years.

Hay and Grain Consumed by Livestock

Livestock Enterprise (A)

Hay—65 tons (surplus 43 tons)

Oats—295 bus. (surplus 700 bus. excluding seed)

Barley—295 bus. (surplus 975 bus. excluding seed)

Livestock Enterprise (B)

Hay—70 tons (surplus 38 tons)

Oats—1,020 bus. fed on the farm and used for seed

Barley—1,320 bus. fed on farm and used for seed

(B) INCOME AND EXPENDITURE SUMMARY

Income

Livestock Enterprise (A)		Livestock Enterprise (B)
\$ cts.		\$ cts.
1,125 00	Wheat—900 bus. @ \$1.25.....	1,125 00
350 00	Oats—700 bus. @ 50c.....	
877 50	Barley—975 bus. @ 90c.....	
860 00	Hay—43 tons @ 120.00.....	
	38 tons @ \$20.00.....	760 00
2,184 00	Sugar beets—156 tons @ \$14.00.	2,184 00
3,024 00	Cattle—(A) 21 x 900 @ 16c....	
	(B) 67 x 900 @ 16c.....	9,648 00
Total 8,420 50		13,717 00

Expenditures

Livestock Enterprise (A)		Livestock Enterprise (B)
\$ cts.		\$ cts.
1,800 00	Total machinery cost—15% of \$12,000.....	1,800 00
300 00	Gas, oil and grease.....	300 00
100 00	Taxes.....	100 00
800 00	Hired Labour.....	800 00
350 00	Threshing.....	350 00
350 00	Buildings, fences, etc., 7% of \$5,000.....	350 00
120 00	Fertilizer.....	120 00
156 00	Servicing costs.....	
300 00	Miscellaneous supplies.....	300 00
1,500 00	Cost of producing sugar beets (12 x 125.00).....	1,500 00
	Purchase of calves 325 lbs. x 18c. x 70.....	4,095 00
5,776 00		9,871 00
2,644 50	Gross returns.....	4,002 00
1,000 00	Living costs.....	1,000 00
1,644 50	Return to Irrigation.....	3,002 00
10 28	Per Acre Return to Irrigation....	18 76

The budget estimates presented for two types of livestock enterprises in the initial and mature development stages represent returns to irrigation which can be readily realized on this project. The yields assumed are modest, the prices are conservative. It is realized that the two types of livestock enterprise illustrated cannot be universally applied. If the farmer is to purchase calves in the fall, he would be required to make a fairly large capital outlay. Not all would be able to do so. This problem could be partly overcome by co-operative credit financing. At the same time, the availability of supply of calves might place some limitation on the extent to which this enterprise could be followed, and thus, beef production on many farms would be along the lines of the farm beef herd. Alternative farm livestock enterprises, producing similar or slightly higher returns, would be sheep and dairy production.

In regard to specialty crop production in the mature development phase, while sugar beets are used for illustrative purpose they would not necessarily be grown over the entire project. Other specialty crops will no doubt be grown. The returns from sugar beets as given in the budget is used to illustrate the approximate returns from specialty crops.

On this basis it may be expected that irrigated land on the Central Saskatchewan River Development will produce a return to irrigation of between \$7 and \$16 per acre in the initial development stages, with the figure of \$10 per acre as an average value.

In the mature development stage the project can be expected to return between \$10 and \$18 per acre to irrigation with \$14 per acre as an average value.

On the basis of 430,000 acres under irrigation the project can be expected to return over \$4,000,000 annually to irrigation in the initial development phase and slightly over \$6,000,000 annually in the mature development phase.

(iii) CONTRIBUTIONS OF THE CENTRAL SASKATCHEWAN DEVELOPMENT TO NATIONAL AGRICULTURAL PRODUCTION

By projecting the budget estimates of yields over the entire project it is possible to arrive at the major contributions, in terms of production which the development will make to the Canadian agricultural economy. This will be done for six products: wheat, oats, barley, hay, specialty crops and livestock.

Wheat—In the initial development stage the project will produce 1,100 bushels of wheat for sale per farm or a total of nearly 3 million bushels. Using the 1951 export price of \$1.79 per bushel for No. 3 Northern wheat, the value of wheat production would be \$5,370,000.

In the mature development stage less wheat would be produced; some 2,430,000 bushels which, on the above valuation would be worth \$4,350,000.

Barley—On the basis that well over half the barley produced on the project would be fed to livestock, an average of 425 bushels per farm in the initial development phase and 485 bushels in the mature development stage would be available for sale, or a total production of 1,147,500 bushels and 1,309,500 bushels.

Assuming the 1951 export price of No. 1 feed barley at \$1.25 per bushel, the value of barley production would be \$1,434,375 and \$1,636,875, for the two development stages.

Oats—Assuming again that well over half the oats produced would be fed on farms, about 320 and 350 bushels per farm or a total of 864,000 bushels in the initial development stage and 945,000 bushels at the mature development stage would be available for sale. The value of production using the 1951 export price of 78.6 cents per bushel for No. 1 feed oats would be \$679,000 and \$742,500 respectively.

Hay.—The surplus production of hay in the initial development stage would amount to an average of about 22 tons per farm and 40 tons in the mature development stage. The total amount of surplus hay would be 59,400 tons and 108,000 tons, which at a value of \$20 per ton would be worth \$1,188,000 and \$2,160,000.

Specialty Crops.—In the mature development stage 12 acres per farm will be devoted to specialty crops. Using sugar beets as an example with an average yield of 13 tons per acre, the project would produce 421,200 tons of sugar beets. Assuming 16 per cent sugar content this tonnage would yield 134,784,000 pounds of sugar. At a retail price of 12 cents per pound the value of production would be \$16,174,080.

Livestock.—Beef production would vary from 20,700 lbs. per farm, assuming a farm beef herd, to 38,525 when calves are purchased and fed for a year. Based on a nearly equal division between these two types of enter-

prises, a per farm beef production of 30,000 lbs. is indicated. Assuming a farm selling price of 24 cents which is 60 per cent of retail value, a price of 40 cents is used to calculate the value of livestock production. For the project this would amount to \$31,104,000.

SUMMARY

ANNUAL CONTRIBUTION TO NATIONAL OUTPUT FROM THE CENTRAL SASKATCHEWAN RIVER DEVELOPMENT

—	Initial Development Phase	Mature Development Phase
	\$	\$
Wheat.....	5,370,000	4,350,000
Barley.....	1,434,375	1,636,875
Oats.....	679,000	742,500
Hay.....	1,188,000	2,160,000
Specialty Crops.....		16,174,080
Livestock.....	32,400,000	32,400,000
Total.....	41,071,375	57,493,455
Per Farm.....	15,211	21,282

The above amounts must be considered a gross contribution from which it is necessary to subtract the present value of production of the area under dryland conditions.

On the basis of 1,245 farms, averaging 382 acres of cultivated land, a total dryland acreage of 475,590 is indicated, roughly comparable to 2,700 irrigated farms averaging 160 acres in size for a total acreage of 432,000.

At least a third of this acreage would be in summer-fallow each year, leaving 288,000 acres for crop production. At present this cropped acreage is devoted mainly to cereal production; 70 per cent in wheat, 16 per cent in oats, 8 per cent in barley and the remaining 6 per cent in other grains and feed crops. Livestock numbers are few and marketings of about 5 head per year are indicated. Production is estimated as follows:

—	Acreage	Yield	Total Production
Wheat.....	201,600	11 bus.	2,217,600 bus.
Oats.....	46,080	22 bus.	1,013,760 bus.
Barley.....	23,040	17 bus.	391,680 bus.
Hay.....	17,280	1 ton	17,280 tons
Livestock.....			6,225 head

*Value of Production**

(Less feed and seed requirements)

Wheat	2,000,000 bus. @ \$1.79	= \$3,580,000
Oats	885,520 bus. @ 78¢	= 696,018
Barley	322,560 bus. @ \$1.25	= 403,200
Hay	No surplus	
Livestock	6,225 x 900 lbs. @ 40¢	= 2,241,000
Total.....		\$6,920,218
Per Farm (1,245 farms).....		\$ 5,558

* Based on 1951 prices as used for irrigated farms.

Net Annual Contributions of the Central Saskatchewan River Project to National Agricultural Production

Initial Development Stage.....	\$34,151,157
Mature Development Stage.....	\$50,543,337

4. Food and the Central Saskatchewan River Development

There is much evidence to show that there is little reason to look back at food surpluses and low relative prices for food products, as a guide to what may happen in the future.

The era of expanding agricultural acreage that continued from 1900 to 1930 in North America is now over and only small areas still await development. Mechanization has since freed large acreages (estimated at about 65 million in the United States) for production of human food. No similar frontier can be foreseen for the next 2 or 3 decades at least.

Populations continue to increase. The following table sets out population statistics in Canada's major customers countries since 1931:

	1931	1941	1951
Canada	10,377,000	11,507,000	14,009,000
United States ...	123,643,000	132,638,000	150,161,000
Great Britain	44,795,000	46,467,000	50,363,000
Total.....	178,815,000	190,612,000	214,533,000

It seems likely that an era of considerable economic expansion, sparked by discoveries of oil, natural gas, iron ore and uranium as well as by a mounting requirement for food, is in store for Canada. A forecast of well over 20 million people in Canada by 1971 is not optimistic. If the rate of growth and development experienced during the past decade were to continue, and there is every indication it will, this figure will be reached easily.

Regarding forecast of population in the United States, Joseph S. Davis of Stanford University, in an article, "Our Amazing Population Upsurge", *Journal of Farm Economics*, November 1949, had this to say:

"Ten months ago the standing official forecast for 1970 was, in round figures, 160 million, and this was the figure commonly used by economists. Six months ago, the revised official forecast indicated that this figure would be reached in 1960. Evidence now available strongly suggests that our true population will reach 160 million during 1955, if not earlier."

In discussing future food requirements he went on to say—

"In conjunction with our higher consumption standards, I believe that our demand for milk, meat and other animal products will become such as to put pressure upon our ability to expand the output of these products."

It may be assumed that Great Britain has reached a static point in population but it is at a considerably higher level than during the thirties. However, F.A.O. estimates that since 1936 world population has increased by thirteen per cent. In the *Demographic Year Book* of the United Nations Statistical Office it is estimated that world population since 1920 has been increasing at just under one per cent per year. As against this F.A.O. estimated that production of principal food crops in both 1951 and 1952 would be only about nine per cent above the 1934-1938 average.⁶

Income is also a major factor in determining demand for food. It has an important bearing on the kinds of food required. Again there appears to be justification for assuming that food products will in the future enjoy a more favourable price relationship.

Furthermore, with increased mechanization of farms, production costs have become fixed. In addition the services which rural people now require and which are now in effect cannot be supported by the land without good prices for the products produced.

Governments, generally, indicate a determination to prevent the drastic declines in incomes that have occurred in the past. In addition, governments in Canada, the United States and Great Britain have introduced various measures that will tend to offset depression effects. In Canada, for example, family allowances, universal old age pensions, unemployment insurance and other measures would alleviate the effects of depression.

In balancing agricultural benefits of the Central Saskatchewan Project against escalated construction costs, it seems only fair to assume corresponding increases in future prices for agricultural products; and

⁶ S. C. Hudson, *Economic Annalist*, No. XXII, Feb. 1, 1952.

most unrealistic to assess the value of production in terms of prices that have prevailed during the past forty or fifty years. These prices were established during a period that witnessed an increase in improved land acreage between 1901 and 1950 of about 160,000,000 acres in the United States and Canada. The same period also witnessed a revolution in the techniques of agricultural production. It resulted in freeing, for human food production, about two-thirds of the acreage required to maintain a population of horses and mules which reached a total of almost 30 million in the United States and Canada in 1920-21.

Requirements for food will inevitably increase in view of population increases, the industrial expansion taking place in Canada and the role that food now plays in international affairs. There seems ample justification for assuming that:

- (a) There is a need for expanding food production.
- (b) Agricultural products will command higher prices during the next 20-50 years than they did during the past 50 years.
- (c) The Central Saskatchewan River Development will play a vital role in meeting the increased demand for food in addition to making a substantial contribution to national income.

5. Summary

As a means of alleviating the serious effects of drought over a wide area of Southern Saskatchewan, it is submitted that the proposed development offers an opportunity and a challenge to the Canadian people to make the best use of our two most important natural resources—soil and water.

In terms of agricultural production the project will result in a vastly increased food output, particularly of animal products, in addition to saving various assistance and relief expenditures, supplying a reservoir of assured feed and seed production for the drouth areas and stabilizing the economy of the province by providing a sure crop area.

Considering only the 430,000 irrigable acres within the project area, the number of farms will be more than doubled and production will be three to four times greater. Hay yields will be increased from an uncertain $\frac{3}{4}$ ton per acre to an assured 3 tons per acre. Instead of 12 acres required to pasture a cow, $\frac{1}{2}$ to $\frac{3}{4}$ of an acre will be enough. In terms of beef, 500 lbs. per acre will be produced compared to 40 lbs. at present. Summerfallow which occupies over $\frac{1}{3}$ of the acreage will disappear and various types of specialty crops will be grown as well as significant amounts of grains for livestock feed.

On the basis of a conservative valuation of production, the project can be expected to return to irrigation over \$4,000,000 annually in the initial development stage and over \$6,000,000 annually in the mature development stage.

In terms of national production the project is expected to contribute thirty-four million dollars annually in the initial development stage and fifty million dollars annually in the mature development stage over present dry land returns.

The large volume of food which the project is capable of producing will be urgently needed in view of expanding world and national food requirements.

As a national investment the Central Saskatchewan River Development is vital to Canada and should be proceeded with immediately.

PART III

September 11, 1952.

Dr. T. H. Hogg,
Chairman,
Royal Commission on the South
Saskatchewan River Project,
406 Elgin Building,
Ottawa, Ontario.

Dear Sir:

I have the honour to present herewith a Submission of the Industrial Development Office of the Province of Saskatchewan to your Commission.

Your Commission will undoubtedly consider the local and national industrial benefits arising from the Central Saskatchewan Development and it is hoped that this brief will be of assistance in this regard.

Yours sincerely,

D. H. F. BLACK,
Director,
Saskatchewan Industrial
Development Office.

INDUSTRIAL DEVELOPMENT

As the South Saskatchewan River Project is designed primarily to assist the agricultural industry through the provision of irrigation facilities, the most substantial benefits accruing from this project will take the form of stabilizing and rendering more prosperous the agricultural industry of the development area and other areas of the province.

However, the benefits resulting from the construction of the South Saskatchewan dam will not by any means be limited to the agricultural industry, but will also result in important developments in the fields of industry and commerce, and of tourism.

While the most important benefits will accrue following the completion of the dam and the putting into operation of the irrigation facilities made possible by the dam's construction, benefits to industry and commerce in Saskatchewan, as well as in Canada generally, will become immediately apparent upon the commencement of construction of the dam. Some of these benefits might be listed briefly as follows:

1. Purchase of materials and supplies.
2. Purchases of machinery.
3. Provision of employment for hundreds or possibly thousands of Saskatchewan citizens,
4. Development of a reasonably large community at the dam location providing employment in the construction of houses and at the same time supplementing services to the farming community in the district.

It is difficult to assess accurately what proportion of the expenditure of something over \$100,000,000 will result in increased economic and business activity in the province of Saskatchewan, but it may be assumed that a large proportion of the total capital costs will be spent in this province and will result in considerably more business activity within the province than would be represented by the actual financial outlay for the project itself.

In addition, substantial economic benefits would accrue to eastern Canada, which would supply the larger proportion of the millions of dollars of machinery and other supplies required to construct the dam.

Although many of the benefits accruing during the period of construction of the dam would be of a transitory nature, the actual operation of constructing the dam with the industrial and commercial activity which such construction would create, would effect some changes in the economic life of the province which would continue on after the date of completion of the dam. These would include the manufacturing establishments set up in the province to manufacture certain materials and supplies for construction. In addition, a new community would have been established at the site of the dam.

More important are the developments which would take place following and as a result of the construction of the dam. These might be listed as follows:

1. Services for an expanding community,

2. Manufacturing establishments to process vegetable and animal products,
3. Other industry utilizing power and water facilities at the dam site.

1. Services for an Expanding Community

Completion of the project will result not only in doubling of the farm population of the development area, but should result in a more than equal increase in that segment of the population servicing the needs of the farming community and including those engaged in industry, commerce, and in the professions including machine shops, wholesale and retail establishments, doctors, dentists, teachers, etc. Inasmuch as the farm lands in the development area now produce lower than normal yields in terms of provincial averages, it is reasonable to assume that aside from partially subsidized services such as education and public health, the service facilities in the area fall below the normal for the province, as an area acquires only those facilities which it can afford.

It is not illogical to conclude, therefore, that the economic activity of the area in terms of service industry, commerce and professional services, will quadruple as a result of the construction of the dam for the following reasons:

1. It is estimated that the farm population itself will double,
2. As the earning capacity of each separate farm unit will be greater than at the present time, the expendable surplus or the purchasing power of each unit will be considerably greater,
3. As the operations of the farms themselves will involve greater mechanization with increased operating costs, not only per acre of land, but also per farm unit, the area will need and be able to support a substantially greater service industry,
4. The development of processing and other industries in the area, with increased population which such activity entails, will result in still further increases in the service requirements of the district.

It is very difficult to accurately assess the extent of increase in service activities in the area, but we understand that the experience of communities in the province of Alberta which have been provided with irrigation facilities, amply justifies the approximate estimate of expansion referred to above.

2. Processing Industries

There is little doubt that the completion of this project will immediately result in the establishment of innumerable factories for the processing of vegetable and animal products which will be produced in the area. Again we would refer to the developments which have already taken place in the province of Alberta in irrigated regions, and suggest that a similar, if not greater, development will take place in Saskatchewan.

As most of the produce of an irrigated area is perishable by nature, it must be processed within the economic area. Plants would undoubtedly be constructed to can the many vegetable products which would be produced, such as beans, peas, tomatoes, corn, etc. By the same token it is very likely that a large sugar beet refining plant would be established in the area. Increased production of livestock would in turn result in increased industrial activity in the province, serving to increase the productivity of presently existing meat packing plants in the province and undoubtedly resulting in the establishment of additional plants. It should be recognized that the production of packing plants in any area depends not so much upon the market for their products, but rather upon the supply of animals available for slaughtering.

In addition we should look forward to the establishment of a milk canning plant in the area. Consideration has been given from time to time by national milk canning concerns to the establishment of branch plants in western Canada, and although there is more than an ample market for such a plant on the prairies alone, the establishment of such a plant or plants has been postponed due to the fact that the availability of raw milk in any concentrated area is marginal only, and might not provide sufficient assurance of availability of raw materials to an expanding industry. With the concentration of farming in the development area, linked with an important trend towards dairy farming, the marginal aspects of availability of raw material should disappear.

3. Other Industries

The completion of the project will make available two very important industrial facilities which are conditions precedent to the establishment of many important industries, namely, cheap hydro electric power and abundant sources of industrial water. The lack of these two important facilities has been the principal cause for the failure of a number of industries seeking establishment in Saskatchewan communities. With a continuation of discoveries of oil and natural gas in the area contiguous to the development area, and probably within the area itself, additional

incentives will exist for the establishment of industry based on the use of oil and natural gas as fuels and raw materials.

4. Tourism

One of the most interesting developments which should take place, not only from the point of view of economics, but also from the point of view of social benefits, would take the form of the development of an important tourist industry. It is true that Saskatchewan is blessed with a number of beautiful vacation playgrounds, principally north of Prince Albert, as well as at a number of locations in the Southern portion of the province. It is equally true to say, however, that the northland is accessible to only a very small proportion of the citizens of the province, by reason of its distance from the majority of the province, together with the time required and cost involved in vacationing in this area.

Vacation facilities do exist in the southern portion of the province, but these are relatively few in number and again, accessible to only a portion of the population.

With the creation of a lake having a shoreline some 400 to 450 miles long, we can look forward to the creation of a new oasis available equally to the residents of the southwest and west central portions of the province, as well as to the residents of the cities of Regina, Saskatoon, and Moose Jaw and intermediate farming communities.

Based on patterns already developed in the province, we could also expect a substantial influx of tourists from the United States, impelled by a desire to travel to a foreign land in search of clear, fresh waters well stocked with fish.

5. Conclusions

The completion of the project would result, not only in the physical developments referred to above, but would have an immeasurable stabilizing effect upon the economy of the province, making it less dependent upon its one crop source of revenue, dependent as it is upon national and international factors. Furthermore, it would have a very decided stimulating effect at this period of the province's industrial development, giving encouragement to our own industrialists to expand their present facilities, and providing a greater advantage to outside capital to establish their plants in an expanding province:

PART IV

SASKATCHEWAN POWER CORPORATION

September 11, 1952.

Dr. T. H. Hogg,
Chairman,
Royal Commission on the
South Saskatchewan River Project,
Ottawa, Canada.

Dear Sir:

The Saskatchewan Power Corporation, as the provincial authority responsible for meeting the growing demands for electric power throughout the province of Saskatchewan, is vitally concerned with the power aspects of the South Saskatchewan scheme.

Not being blessed with natural hydro-electric power sites, we are continuously seeking new power sources especially those which would tend to reduce the overall cost of power.

The load growth on the Saskatchewan Power Corporation system during the last four years has been at the rate of 20% per year compounded. Even with this recent increase (doubling in four years) the per capita consumption in Saskatchewan in 1951 was still very low compared with other provinces, being half that of Alberta and one seventh that of Manitoba. The greater consumptions in Manitoba and Alberta with the attendant economic benefits, are in proportion to the availability of low cost hydro power.

During the past five years the Saskatchewan Power Corporation has been building a high tension network to bring lower cost central station power from large steam plants to areas formerly served by higher cost diesel plants. These high tension lines are designed suitable for higher voltages to carry future loads. Further reduction in power costs will depend upon the efficient use of the high tension network and the development of lower cost power sources.

The Saskatchewan Power Corporation presents herewith a brief to show that the power from the South Saskatchewan River Project could be effectively integrated with the Provincial Power System, thereby substantially reducing the overall cost of electric power to the consumers of Saskatchewan.

Yours truly,

(sgd) J. W. TOMLINSON, B.Sc., E.E., P. ENG., M.E.I.C.,
General Manager, Saskatchewan Power Corporation.

W. B. CLIPSHAM, B.A.Sc., P. ENG., M.E.I.C.,
Chief Engineer, Saskatchewan Power Corporation.

INTEGRATION AND VALUE OF HYDRO-ELECTRIC POWER

1. *Integration of the Hydro-Electric Power with the Provincial Power System*

Present planning for the proposed Central Saskatchewan Development calls for an initial generating capacity of 100,000 Kw. (134,000 H.P.) with provision for additional generating units for an ultimate installed capacity of 150,000 to 175,000 Kw. (200,000 to 234,000 H.P.). This planning is based on estimates by the Prairie Farm Rehabilitation Administration indicating the availability of 325,000,000 Kw. Hrs. of firm commercial energy, 50,000,000 Kw. Hrs. of firm energy for irrigation pumping, and 100,000,000 Kw. Hrs. of secondary energy.

The power plant will be connected to the provincial high tension transmission system and will be operated in conjunction with steam-electric generating stations in the Northern portion of the system and the proposed hydro-electric generating station at Fort a la Corne. The ample water storage facilities to be provided by the Coteau Creek dam will permit great flexibility in the use of the available water, so that the power output can be delivered at times and in quantities most suitable to the efficient operation of the whole system. As will be demonstrated below, the available energy can be utilized with the initial 100,000 Kw. of installed capacity. However, as the system load increases, more installed capacity will be required to supply demands over peak load periods. The installation of additional generating units at the Central Saskatchewan Development from time to time up to a total of 150,000 to 175,000 Kw. will provide the necessary peak load capacity at minimum system cost.

By the time the Central Saskatchewan Development can be brought into production (assumed for this study to be in the latter part of 1963) the contiguous system demand is estimated at 220,000 Kw. and energy requirements of some 800,000,000 Kw. Hrs. There will be available at Fort a la Corne 96,000 Kw. of installed capacity and 598,000,000 Kw. Hrs. There will be steam-electric capacity of 125,000 Kw., which will provide the balance of energy requirements. The Central Saskatchewan Development will have an initial installed capacity of 100,000 Kw. and energy of 325,000,000 Kw. Hrs. available for integration with the then existing plants.

TABLE 1.—Generating capacity and Peak and Energy Allocation for Interconnected Northern Saskatchewan System

Year	System Requirements			Fort a la Corne			
	Peak Kw. x 1000	Kw. Hr. x 10 ⁶	Load Factor	Installed Capacity Kw. x 1000	Peak Demand Kw. x 1000	Kw. Hr. x 10 ⁶	Load Factor
			%				%
1962.....	210	790	42.8	96	96	584	69.4
1964.....	240	917	43.5	96	96	598	71.0
1966.....	270	1,060	44.8	96	96	598	71.0
1968.....	300	1,200	45.6	96	96	598	71.0
1970.....	330	1,320	45.6	128	128	598	53.0
1972.....	364	1,452	45.6	128	128	598	53.0
1974.....	401	1,600	45.6	160	160	598	42.5
1976.....	441	1,760	45.6	160	160	598	42.5
1978.....	486	1,936	45.6	160	160	598	42.5
1980.....	535	2,130	45.6	160	160	598	42.5
1982.....	588	2,345	45.6	160	160	598	42.5

Year	Steam Electric				Central Saskatchewan Development					
	Installed Capacity Kw. x 1000	Peak Demand Kw. x 1000	Kw. Hr. x 10 ⁶	Load Factor	Reserve Capacity Kw. x 1000	Installed Capacity Kw. x 1000	Peak Demand Kw.	Kw. Hr. x 10 ⁶	Load Factor	Total Installed Capacity In Reserve
				%					%	%
1962.....	125	114	206	20.6	11					
1964.....	125	44	107	27.8	81	100	100	212	24.2	25.2
1966.....	125	74	175	28.0	51	100	100	287	32.6	15.9
1968.....	150	104	277	30.4	46	100	100	325	37.0	13.3
1970.....	150	102	397	44.4	48	100	100	325	37.0	12.7
1972.....	175	136	529	44.3	39	100	100	325	37.0	9.7
1974.....	200	141	677	54.7	59	100	100	325	37.0	12.8
1976.....	225	181	837	52.8	44	100	100	325	37.0	8.9
1978.....	250	201	1,013	57.6	49	125	125	325	29.6	9.2
1980.....	275	225	1,207	61.3	50	150	150	325	24.7	8.5
1982.....	300	253	1,422	64.3	47	175	175	325	21.1	7.4

Table 1 shows how the annual peak and energy requirements can be allocated between hydraulic and steam plants in 1962, and how the Central Saskatchewan Development can be integrated with these in subsequent years. Operation of the Coteau Creek plant will result in the immediate reduction of active steam plant capacity of 44,000 Kw., leaving 81,000 Kw. of capacity as system reserve for emergent use and for load growth. Additional generating units at Fort a la Corne in 1970 and 1974, and additional steam-electric capacity in 1968, 1972, 1974 and 1976 would be necessary to supply peak load and increased energy requirements.

In 1978, 1980 and 1982 the increase in demand and energy requirements could be met by both steam-electric and hydro-electric installations, the former to supply growth in energy, the latter to supplement the former in providing the necessary peak capacity. The hydro installation would be at Coteau Creek.

It will be noted from Table 1 that the full amount of available energy at Coteau Creek was not utilized until 1968. The difference represents the accumulated surplus of monthly availables at Coteau Creek which were not utilized during the high flow periods at Fort a la Corne, owing to rigid adherence in this study to the

monthly allocations shown on Table 2. In practice these surpluses could be utilized in subsequent months, or the water could be applied to filling the storage reservoir, since it is unlikely that the reservoir will be completely filled by the time the generating plant is ready for service.

The difference in installed capital cost of steam-electric and hydro-electric units in favour of the latter would make economic the increases in hydro-electric capacity to meet peak demands when sufficient energy is available from steam-electric plants. The steam plants would operate at higher load factors, resulting in lower generating cost per energy unit. Increasing the installed capacity of hydro-electric plants, with no increase in total hydro-electric energy, would increase the cost per energy unit. In general, this process could be continued until the costs per unit were equal, or until a limit was reached owing to water storage capacity, or downstream flow conditions. Coteau Creek plant, with its large pondage, is well suited to operation as a peak load station.

TABLE 2—*Monthly Allocation of Hydro Electric Energy*

—	Fort a la Corne	South Saskatchewan River Project
	Kw. Hr.	Kw. Hr.
January.....	28,600,000	29,300,000
February.....	26,000,000	25,400,000
March.....	30,300,000	27,000,000
April.....	53,200,000	24,800,000
May.....	65,700,000	25,000,000
June.....	61,500,000	24,200,000
July.....	63,600,000	24,400,000
August.....	64,300,000	25,800,000
September.....	63,800,000	25,900,000
October.....	66,700,000	29,000,000
November.....	45,200,000	30,200,000
December.....	29,500,000	34,000,000
Total.....	598,400,000	325,000,000

Fort a la Corne—Monthly allocation of energy as in supplement to the 1931 report on Power Development by H. G. Acres for an installed capacity of 96,000 Kw.

Central Saskatchewan Development—Monthly allocation of energy based on the system distribution of energy per month.

Table 1 illustrates the distribution of peak and energy between plants on annual basis. The variation in demand from day to day and from hour to hour will affect the optimum allocation of load between plants.

The accompanying charts will serve to illustrate the ability of the installations to share the peak and energy requirements of typical daily load curves.

Figure 1A represents a load curve for the peak day in December, 1964, and would be representative of the year's peak. The steam plants would carry a base load of 44,000 Kw. (44 Mw.) at 100 per cent load factor. The Central Saskatchewan Development would supply the balance of demand between 0 and 7:00 hours, and would supply 76,000 Kw. (76 Mw.) continuously from 7:00 to 23:40 hours, except during the period between 16:40 and 18:40 hours when additional output up to the capacity of the station would be utilized to carry the peak load. The Fort a la Corne plant would be operated between 7:00 and 23:40 hours to carry the load variation up to its maximum capacity. The available water for the day would be fully utilized at both hydraulic plants, and the steam plant would operate at maximum efficiency.

The high river flows at mid-year would enable the Fort a la Corne plant to operate on base load. On a peak day in June, 1964, as illustrated by Figure 1B, Fort a la Corne could carry the bulk of the energy required for the day, with Coteau Creek plant carrying the variation during the peak period. No steam-electric generation would be required. Surplus water at the Central Saskatchewan Development could be stored for use during low flow periods.

By 1982 the steam plants would be required to supply the greater part of the energy and would operate continuously at high load factors. The available water would be utilized in the hydraulic plants to fill in the heavily loaded portions of the day. Figure 2A indicates that for the peak day in December, 1982, an installed capacity of 175,000 Kw. (175 Mw.) could be utilized with advantage. The energy requirements from the Central Saskatchewan Development for the peak day are in excess of the daily average for the month. Figure 2B indicates how water can be stored on off peak days by using minimum water from the Development and making up the energy requirements from the steam-electric plants.

Figure 2C illustrates again for June, 1982, the practicability of operating Fort a la Corne on base load during the high flow period, and the storage of water at the Central Saskatchewan Development for later use.

It would be noted that in the above discussion new installations were referred to as occurring in specified years. Actually these installations will be required when loads reach the values shown. The time scale applies only if the actual load growth agrees with the estimated growth.

2. Annual Value of the Central Saskatchewan Development Power to the Saskatchewan Power Corporation

The value of this hydro power is determined by the cost of steam-electric power. For a large steam-electric station the cost has been estimated at 7.5 mills per Kw. Hr. The estimated cost of extra transmission lines and associated losses for the hydro plant is approximately 2 miles per Kw. Hr. The firm hydro power is thus worth 5.5 mills per Kw. Hr. The non-reliable or secondary energy is worth 3 mills (fuel cost less transmission losses) on account of steam plant capacity required for dry periods.

Taking the firm energy at 325,000,000 Kw. Hrs. and the secondary energy at 100,000,000 Kw. Hrs. annually, the annual savings are:

Income			
325,000,000 Kw. Hrs. at 5.5 mills—	\$1,788,000		
100,000,00 Kw. Hrs. at 3.0 mills==	300,000	\$2,088,000	
Costs (on a capital investment of ten millions)			
Interest at 4 per cent	\$ 400,000		
Depreciation at 2 per cent	200,000		
Maintenance and operation at 2.5 per cent	250,000		
Contingencies at .5 per cent	50,000	\$ 900,000	
Annual Saving		\$1,188,000	

The irrigation pumping energy of 50,000,000 Kw. Hrs. annually has not been included in the above since it has been specifically reserved for pumping purposes. Initially, and in wet years, the total of 50,000,000 Kw. Hrs. may not be required for pumping. Whereas energy allotted to pumping and not required might be considered as secondary commercial energy, it could only be valued as such if utilized. Since its use would follow full utilization of the above mentioned 100,000,000 Kw. Hrs. of secondary energy, and the ability of the system to absorb large amounts of secondary energy would be limited, particularly in the early years, the value of the unused pumping energy is somewhat debatable and has not been included above.

Additional savings would also be realized from the increased power available from hydro installation downstream from the Central Saskatchewan Development due to the regulated flow. Fort a la Corne would be the only plant from which savings would be realized immediately since it appears probable that it would be completed before the Development. Some of this energy can be utilized without any additional installation so that it could be valued at 5.5 mills per Kw. Hr. The remainder would require additional installed capacity and would be valued at 3 mills per Kw. Hr., i.e.,

5.5 mills less fixed charges on the required installation. Assuming that 50 per cent of the 100,000,000 Kw. Hrs. is recoverable without additional installations, the additional saving would be:

50,000,000 Kw. Hrs. at 5.5 mills==	\$275,000.00
50,000,000 Kw. Hrs. at 3.0 mills==	150,000.00
Total=	\$425,000.00

Conclusions

1. The Central Saskatchewan Development will provide pondage and flows sufficient for the operation of a hydro-electric generating station with an initial installed capacity of 100,000 Kw., and an ultimate capacity of 150,000 to 175,000 Kw., when integrated with other generating plants on a large inter-connected transmission system. The installed capacity is not limited by the available supply of water, but by the ability of the system to absorb the available energy to best advantage in competition with other sources.

2. With a 100,000 Kw. or larger station, there is adequate installed capacity to provide for 34,000 Kw. of irrigation pumping load during the summer months (see Figures 1B and 2C).

3. Secondary energy which may be available in years of higher flows can be generated during off peak hours with equivalent reduction in steam-electric energy and without increasing the installed capacity.

4. Economically the hydro installation at the Coteau Creek dam appears sound with an indicated annual saving over steam-electric generation of \$1,188,000 and indirectly resulting in an additional annual saving of \$425,000 from Fort a la Corne. Electric energy in Saskatchewan is costly in comparison with provinces having hydro-electric power, resulting in an economic disadvantage to the population of Saskatchewan which has the third lowest consumption per capita in Canada. This disadvantage would be reduced by the development of hydro-electric energy sources within the province.

5. The efficient integration of the hydro-electric energy with the generating facilities in the northern part of the S.P.C. system is demonstrated. The central location of the Central Saskatchewan Development lends itself to integration with the southern portion of the system should such prove advantageous, and is likewise well situated for integration with the system as a whole. It is, therefore, adaptable to trends in load growth which may favour one portion of the whole system more than another.

TABLE 3.—1951 Monthly Distribution of Peak Demand and Energy

Month	% Energy Distribution	% of December Peak	% L.F.
January	9.02	89.3	51.3
February	7.84	82.2	51.8
March	8.30	72.4	56.4
April	7.63	63.2	61.1
May	7.68	63.5	59.6
June	7.45	62.2	60.8
July	7.50	61.5	59.8
August	7.93	66.6	61.5
September	7.95	65.4	61.5
October	8.91	86.5	50.5
November	9.32	95.0	49.7
December	10.48	100.0	51.4
	100.00		

Annex I

PROCEDURE IN PLOTTING TYPICAL DAILY LOAD AND ENERGY

The monthly distribution of peak demand and energy, expressed in per cent, for the S.P.C. system for the year 1951 is shown on Table 3. It is assumed that this distribution will apply to subsequent years to a reasonable degree.

The monthly allocation of energy from the proposed Fort a la Corne hydro-electric plant, as determined by H. G. Acres and Company (1946 Supplement to 1931 Report) is shown on Table 2, together with an allocation of available annual energy from the Central Saskatchewan Development based on the 1951 distribution experience. The balance of monthly energy required in any year would be made up with steam electric generation.

A comparison of available hydro-electric energy in months of low water flows with energy requirements indicates that December represents the critical month with respect to the ratio of hydro-electric energy to system requirements. Therefore, from an analysis of the daily load curves during the peak month of December, a load duration curve can be derived to show the number of hours during which a given peak load is equalled or exceeded. From this curve, the graph shown in Figure 4 is derived, which shows the percentage of the total energy for the month which there will be in any given percentage of the maximum or peak demand; e.g., the top 20% of the peak would represent less than 2% of the energy for the month.

A similar graph for the peak day in December is shown in Figure 3.

The required installed capacity for the Central Saskatchewan Development can be determined from the December peak and energy requirements and reference to the peak percentage curve for December shown in Figure 4.

Thus for 1964, the system peak (Table 1) is 240,000 Kw. Assuming 100,000 Kw. installed capacity at Coteau Creek for trial, plus 96,000 Kw. capacity at Fort a la Corne, the total installed hydro-electric capacity is 196,000 Kw., which is 81.7% of the system peak. From Figure 4, 81.7% of the peak represents 63% of the energy requirements for the month, or 60,500,000 Kw. Hrs. Reference to Table 3 indicates that 29,500,000 plus 34,000,000 equals 63,500,000 Kw. Hrs. of hydro energy is available, which is adequate to supply the above requirement of 60,500,000 Kw. Hrs. Had the available hydro energy been less than the requirement, it would indicate that the installed capacities were larger than could be fully utilized.

To plot a daily chart such as Figure 1A, the peak for the day (in this case the annual peak) is known in magnitude and is plotted at 100%. The shape of the curve is taken from current experience. The peak percentage curve on Figure 3 was derived from such a daily load curve.

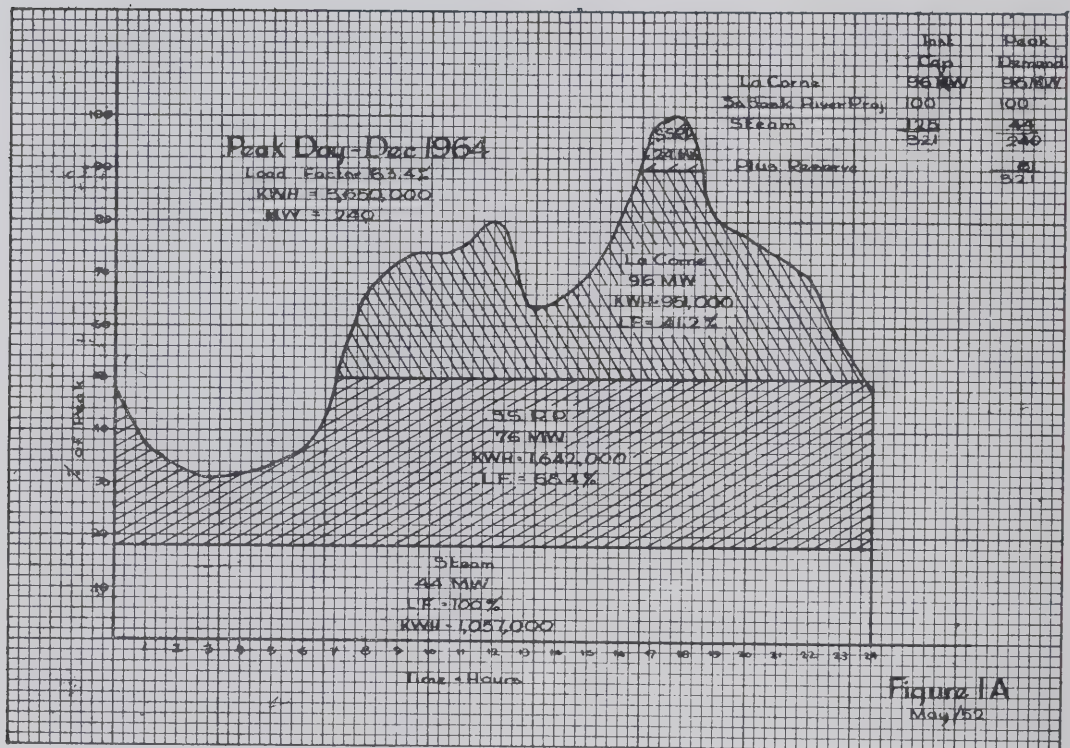
The peak carried by each of the hydro plants and the steam plant had already been established when the installed capacity of the plant was determined.

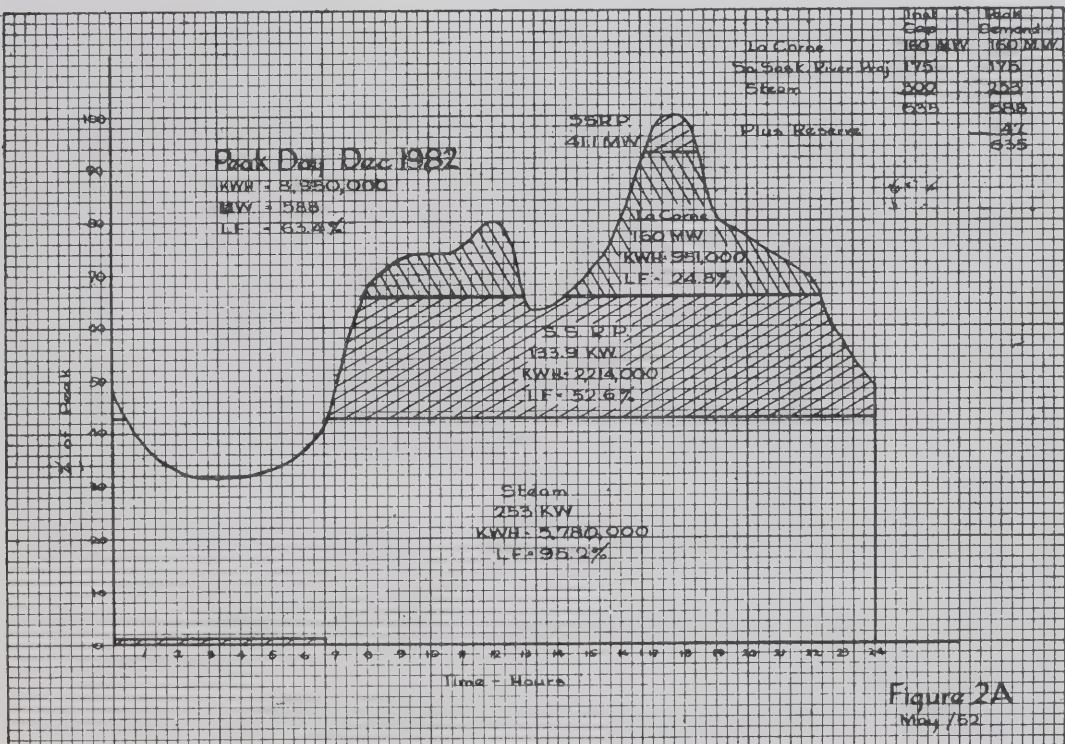
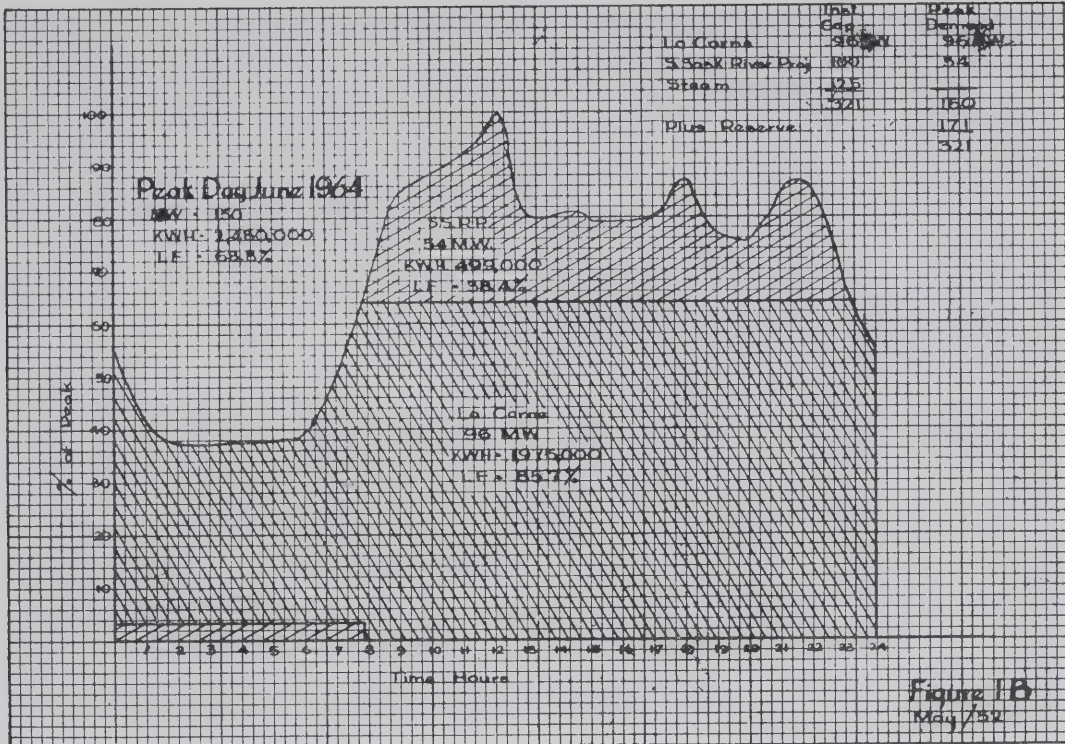
The 44,000 Kw. of steam was put on base load. Assuming that the energy available from Fort a la Corne in any one day was equal to the monthly average of 950,000 Kw. Hrs. a day in December, by trial and error and using Figure 3, the output of Fort a la Corne was fitted into the daily load curve. The Development then had to supply the remaining energy which, for Figure 1A, amounted to 1,642,000 Kw. Hrs. This is more than average daily Kw. Hrs. available for the month of December, but on off peak days assuming approximately the same output from both Fort a la Corne and the steam plant, very little energy would be required from the Coteau Creek plant. In this way the full capacity of the project can be utilized on peak days during low flows. The allocation of energy for a peak day in December, 1982, shown on Figure 2A, was made similarly.

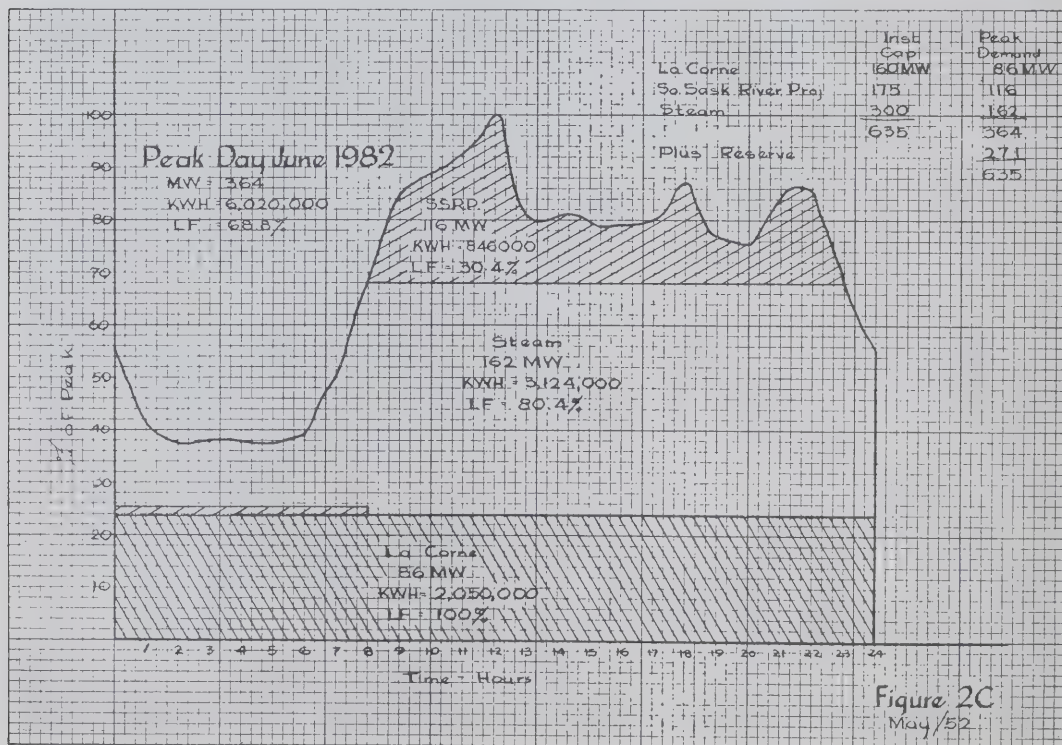
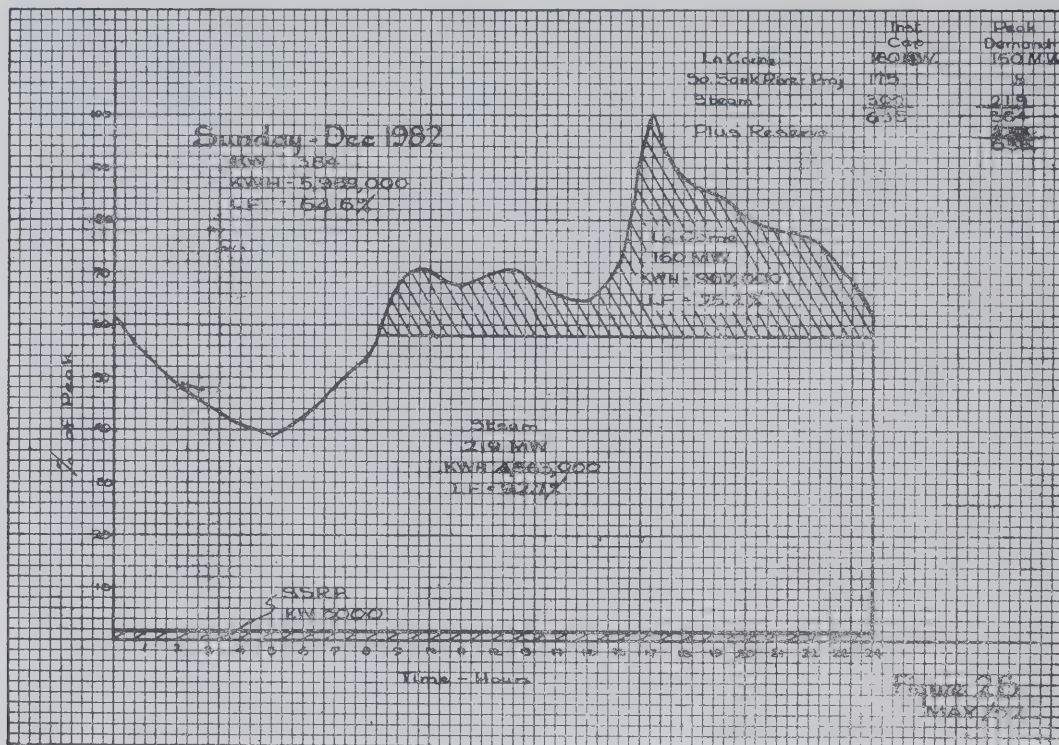
During high flow months the procedure was changed somewhat in that Fort a la Corne was put on base load, rather than the steam plant. This meant that the full installed capacity of the plant could not be utilized in later years with the assumption as to the monthly energy available. However, during flood season, water which would otherwise be spilled

could be utilized up to the full capacity of the installation with consequent increase in the annual Kw. Hrs. developed. The daily energy available from the Central Saskatchewan Development was taken as the

average for that month and fitted into the daily load curve, keeping in mind that 34,000 Kw. of installed capacity had to be available for pumping. The steam plant was then required to make up any deficiency.







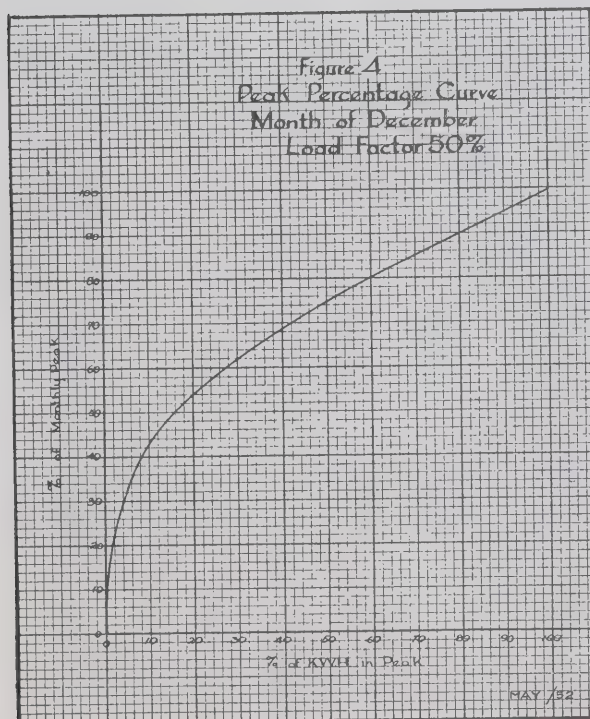
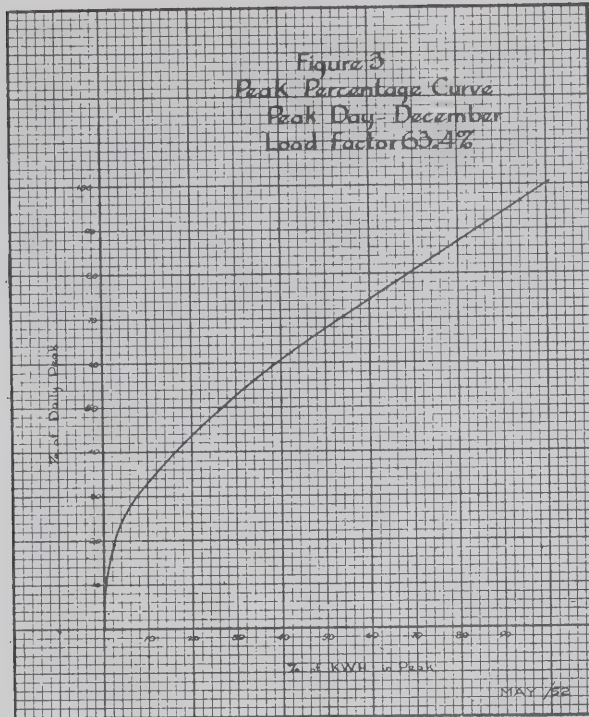
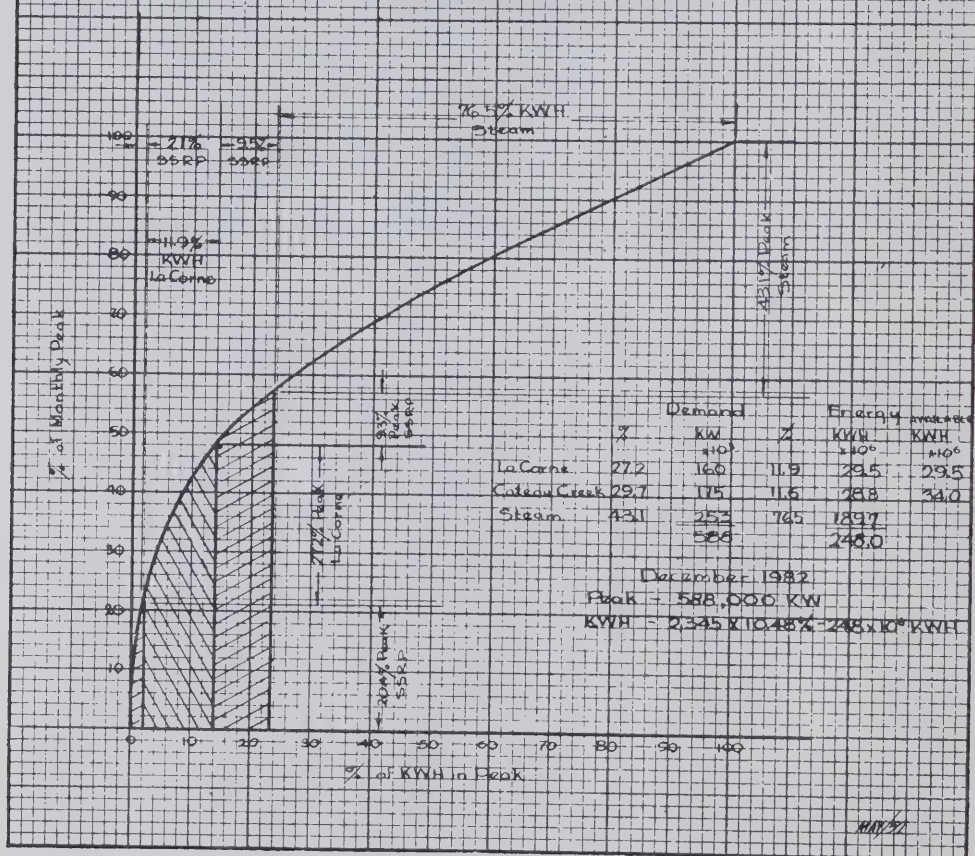


Figure 5 Determination of Hydro Capacity and Energy Output

Dec. 1982 Form
Peak Percentage Curves
For
50% Load Factor



Annex II

ANNUAL PUMPING COSTS, CENTRAL SASKATCHEWAN DEVELOPMENT

Diversion Number	Pumping Lift (feet)	Acreage	Operation Depreciation and Maintenance ¹	Investment Charge ²	Power Costs (3 mills)	Total
			\$/acre	\$/acre	\$/acre	\$/acre
1	Gr.	68,300	.12	.06	.....	.18
2	Gr.	15,300	.08	.05	.....	.13
3	Gr.	12,800	.08	.03	.....	.11
4	Gr.	28,800	.08	.03	.....	.11
5	Gr.	22,500	.08	.03	.....	.11
6	15	15,000	.60	.35	.06	1.01
7	15	18,750	.55	.32	.06	.93
8	15	9,100	.33	.18	.06	.57
9	30	12,750	.93	.54	.12	1.59
10	30	15,000	.73	.42	.12	1.27
11	30	9,100	.87	.51	.12	1.49
12	30	39,600	1.38	.81	.12	2.31
13	30	11,700	.77	.45	.12	1.34
14	30	18,000	.65	.38	.12	1.14
15	60	33,200	.58	.53	.23	1.34
16	60	19,600	.80	.47	.23	1.49
17	60	26,600	.82	.47	.23	1.51
18	120	33,700	1.87	1.10	.46	3.42
19	120	10,800	1.08	.63	.46	2.17
20	120	23,100	.93	.54	.46	1.93
21	120	11,000	1.02	.60	.46	2.18
		448,700				

Average cost per acre with investment charges—\$1.28.

Average cost per acre without investment charges—\$0.83.

¹ Based on aggregate rate of 5 per cent on installation cost to cover depreciation and maintenance plus \$0.03 per acre allowance for operation; depreciation estimate based on 50-year 3 per cent sinking fund for buildings and 20-year 3 per cent fund for pump equipment, weighted 80-20; maintenance estimated at 2 per cent of installation costs (rates based on Engineering estimates).

² Charged at 3 per cent of installation cost.

PART V

GOVERNMENT OF THE PROVINCE OF SASKATCHEWAN

September 11, 1952.

Dr. T. H. Hogg,
Chairman,
Royal Commission on the South Saskatchewan
River Project,
406 Elgin Building,
Ottawa, Ontario.

Dear Sir:

I have the honour to present herewith a Submission of the Water Rights Branch of the Province of Saskatchewan to your Commission.

I trust that this study will be of some interest to the Commission and of significance to its investigation.

Yours sincerely,

E. J. SCAMMEL,
Chief Engineer, Water Rights Branch.

ECONOMIC USE OF WATER

1. *Present Proposals*

Of the many proposed developments for the utilizing of the waters of the Saskatchewan River Drainage Basin there are two at the moment which are under discussion and to which a great deal of study has already been given. A comparison of the two proposals is very completely covered in the Prairie Provinces Water Board Report No. 4, prepared in October, 1951, and the advantages of the separate projects generally concurred in by the investigators. However, although a brief reference is made to the comparison of economic use of water no estimate has been made as to what this amounts to in actual quantity. This study then will attempt to assess the value of the two proposals on the basis of economic use of water.

The two proposals are summarized as follows:

(i) *The North Saskatchewan Project—Proposal No. 1*

To irrigate some 800,000 to 1,000,000 acres in Alberta and Saskatchewan by diverting water from the North Saskatchewan, Clearwater and Red Deer Rivers. (NOTE: The original North Saskatchewan Project (the Pearce Scheme) envisaged some 1,400,000 acres irrigable, of which 480,000 acres were in Alberta and 920,000 in Saskatchewan. Later investigation reduces this area by eliminating less suitable lands and areas where costly canals and syphons were required).

(ii) *Two Separate Projects—Proposal No. 2*

The decision to investigate the irrigation of lands in Alberta and Saskatchewan as two separate projects was arrived at after two independent investigations were made, one by Mr. B. Russell, then P.F.R.A. Senior Supervising Engineer, in 1943, and the other by Mr. S. H. Hawkins, P.F.R.A. Engineer in 1946.

In his report dated June, 1943, Mr. Russell states in part:

"No surveys have yet been made for a possible diversion of the South Saskatchewan River in Saskatchewan, but certain topographical features and elevations would indicate that it may be more desirable and even economical to irrigate the Saskatchewan area from a point in Saskatchewan rather than by a diversion of the Clearwater, Red Deer and North Saskatchewan Rivers in Alberta....

"Some factors in favor of a diversion in Saskatchewan rather than in Alberta are as follows:

- (1) It enables the Province of Saskatchewan to proceed with irrigation development independent of the Province of Alberta.
- (2) It brings the point of diversion closer to the irrigable lands in Saskatchewan, thus saving losses in transportation and maintenance costs.
- (3) A dam on the South Saskatchewan River will serve as a diversion of water for irrigation and also as a water power development for the generation of power for industry in the province.
- (4) The proposed location of a reservoir on the South Saskatchewan River is such that little property damage would result from flooding.
- (5) The Calgary Power Company is spending large amounts of money on the Bow River above Calgary to increase the winter flow for power development. This winter flow is available for the development of power in Saskatchewan."

Mr. Hawkins, in his 1947 report on the "Proposed Red Deer River Diversion Project" states:

"During 1946 it was established by the writer, with the aid of field parties, that the difficulties in the way of taking Red Deer water into Saskatchewan by means of a diversion are very great. A report was made on the proposed Tramping Lake route in August and later the possibility of getting a canal into Saskatchewan at any point south from Macklin to Empress was investigated."

The conclusion is that this can be done only at one place with any expectation of accomplishing much. This point is the Cabri Lake summit used

by Mr. Strome in 1922, which requires a very long and costly syphon and extremely flat grades which can be used only for very large canals, designed to serve immense acreages. It does not appear that any large area will be commanded west of Elrose, as the Kindersley tract is extremely flat, has no drainage, and consists mainly of heavy lacustrine type clay, unsuitable for irrigation. It is now proposed to confine the project entirely to Alberta with the principal tracts centered on Youngstown and Cessford, the estimated total being about 450,000 acres for this highly concentrated area.

An additional isolated tract of about 50,000 acres lies in the Acadia Valley under Benton Reservoir, bringing the potential total for the project to 500,000 irrigated acres."

These two separate proposals are fully covered in the following reports:

1. South Saskatchewan River Project—Summary Report of Investigations, dated April, 1951. This proposes irrigating about 450,000 acres in Saskatchewan by diversion from the South Saskatchewan River.

2. Proposed Red Deer River Diversion Project, by S. H. Hawkins, dated April, 1947. By diverting the waters of the Red Deer and Clearwater Rivers some 350,000 acres of land could be irrigated in Alberta.

There are two alternatives to the separate projects:

- Plus additional water from the North Saskatchewan River into the Red Deer River for the production of additional water power;
- Plus additional water from the North Saskatchewan River to irrigate an additional 250,000 acres through the Red Deer Project and to produce additional power.

2. Estimated Canal Transportation and Reservoir Losses*

(i) Proposal No. 1

	Capacity cfs	Length miles
Canals—		
North Saskatchewan River Canal	6,800	28
Clearwater River Canal	5,500	20
Ardley-Buffero Lake Canal to Craig Lake	10,000	102
Craig to South Saskatchewan Project	3,500	500
South Saskatchewan Project Canals	various	189

	Capacity ac. ft.	Area sq. mls.
Storage—		
Buffalo Lake	500,000	57.0
Ardley	370,000	28.0
Hamilton Lake	150,000	28.0
Craig	100,000	24.0
Sounding & Grassy Creeks	160,000	51.0
Small Reservoir	68,000	40.0
Tramping Lake	320,000	25.0
Small Reservoirs	80,000	40.0
	1,748,000	293.0
Sounding & Eyehill Creeks		
River Storage	252,000	30.0
Total	2,000,000	323.0
		(About 200,000 acres)

*Canal losses estimated at 6 cfs per million square feet wetted perimeter. Reservoir losses estimated at 21 inches net on reservoir area.

Total Estimated Losses for Proposal No. 1.

	Ac. ft.
Canals	1,043,400
Reservoirs	350,000
Total losses—Proposal No. 1	1,393,400

(ii) Proposal No. 2.

Saskatchewan Area (450,000 acres)

South Saskatchewan Project

	Capacity ac. ft.	Area sq. mls.
Storage		
	8,000,000 (gross)	90,000
	4,000,000 (live)	
Canals—Main & Distribution—Various Capacities —189 miles.		
	ac. ft.	
Reservoir Losses	157,500	
Canal Losses	111,600	
Total	269,100	

Alberta Area (350,000 acres)

Red Deer Project

	Capacity cfs	Length miles
Canals		
Ardley to Craig	2,700 cfs.	110 miles
Storage		
	Capacity ac. ft.	Area sq. mls.
Ardley Reservoir	370,000	28.0
Craig Reservoir	100,000	24.0
Hamilton Reservoir ..	150,000	28.0
Small Reservoirs	120,000	40.0
	740,000	120.0
		(About 77,000 acres)

	ac. ft.
Canal Losses	130,000
Reservoir Losses	135,000
Total	265,000
<hr/>	
Total Losses—Proposal No. 2.	
South Saskatchewan	
Project	269,100
Red Deer Project	265,000
Total Losses	534,100

To put both proposals on a comparable basis, i.e., ultimate development and maximum benefits for each province in acres irrigated and power generated (see Prairie Provinces Water Board Report No. 4) then we find the following advantages of having separate projects:

(Combined Projects)	1,393,400
Total losses—Proposal No. 2	
(Separate Projects)	534,100
Difference	859,300

There have been alternative routes suggested for bringing water into Saskatchewan. The most recent is referred to in a report prepared in June, 1952, by the Hydrology Division of the P.F.R.A. on "Full Development Possibilities in the Saskatchewan River Basin." It is believed by an extension of the main canal of the Red Deer Irrigation Project, crossing into Saskatchewan near the Town of Laverna, some 200,000 acres of additional land could be served in the Kinderslay, Kerrobert and Rosetown areas. However, it is known that the soils in parts of these additional areas are not suitable for irrigation and reference is again made to Mr. S. H. Hawkins' report of 1947 on the proposed Red Deer River Diversion project: "It does not appear that any large area will be commanded west of Elrose, as the Kinderslay tract is extremely flat, has no drainage, and consist mainly of heavy lacustrine type clay, unsuitable for irrigation." In the Alberta Government brief to the Royal Commission it was suggested that this canal could be extended to spill water into Tramping Lake where it would then be on common ground to the northern route of the original North Saskatchewan (Pearce) Project.

If this alternative route is feasible, then the length of canal necessary to carry the water to the South Saskatchewan Project might be reduced by 100 miles. It could result in a proportionate reduction in transportation losses of about 20 per cent, equal to about 120,000 acre feet of water. This would be offset to some extent by the losses in an enlarged canal

system required to carry the additional water from the North Saskatchewan River to irrigate these 200,000 additional acres, and by increased storage losses due to the addition of the Sullivan Lake and other smaller reservoirs.

The net saving between Proposals No. 1 and No. 2 would consequently be reduced to 859,300 acre feet—120,000 acre feet=739,300 acre feet.

The advantages in favour of Proposal No. 2 (separate projects) may be summarized as follows:

1. A saving in transportation losses of between 700,000 and 800,000 acre feet of water.
2. Operation and maintenance problems will be reduced considerably. The larger and more extensive an irrigation project becomes, the more difficult it is to operate it. Maintenance troubles on long canals could be serious. Since the combined project would be operated in two different provinces, no savings on administration expenses could be expected. Mr. Victor Meek, Director of Water Resources Division, Department of Resources and Development, Ottawa, in a letter dated February, 1944, stated:

"I have always been a little sceptical of the feasibility of the original North Saskatchewan Project largely on account of its cost, unwieldy size, and the practical difficulty in including lands within two provinces in one development."
3. More than four times as much storage available, thereby providing greater insurance against drought years.
4. Almost complete stream regulation for Saskatchewan and Manitoba, will afford greater measure of flood control.
5. Increases very considerably available hydro-electric energy by bringing into existence power sites on the South Saskatchewan River. (See P.P.W.B. Report No. 4.).
6. Makes most beneficial use of South Saskatchewan River waters for irrigation purposes. Practically the whole of the flow of the South Saskatchewan River can be utilized as against only about 20 per cent under Proposal No. 1. After taking care of prior commitments in both Alberta and Saskatchewan and making allowances for the proposed Red Deer Project there will be approximately 5,000,000 acre feet of water available in the South Saskatchewan River in an average year. If not utilized to irrigate lands through which it flows in Saskatchewan, this water will continue undiminished to the ocean and be completely wasted.

3. Conclusions.

The Government of Saskatchewan wholeheartedly supports any proposal that will fully utilize the water resources of the Saskatchewan River Basin. In the original No. 1 Proposal (Wm. Pearce Project) some 680,000 additional acres of lands in Alberta and Saskatchewan were included as irrigable. These lands

can only be served by diversion from the North Saskatchewan River. Therefore, any other available sources of supply that can be found that will reduce the demand on the North Saskatchewan River cannot be ignored.

The South Saskatchewan River has that available supply and furthermore it places the water naturally right where it is required, with consequent savings in large transportation losses, and it also makes available large supplies of hydro-electric power which otherwise would be an absolute loss.

If the waters of the Saskatchewan River Basin are to be put to the most beneficial use then ultimate development must include full use of the South Saskatchewan River water.

The South Saskatchewan River Project is the answer to that. The development of that project would not be inconsistent with the proposed full development in the Saskatchewan River Basin. It can be constructed as an independent unit and will not affect the development of other projects in the basin.

There would appear to be no logical reason therefore in delaying the construction of the South Saskatchewan River Project.

PART VI

Statement of Counsel for Saskatchewan in Reply to the Submission of the Province of Alberta

There appears to be no question but that in order to stabilize the economy of the Province of Saskatchewan, it is necessary that our water resources be utilized to provide a large area of irrigation in the central part of this Province.

In considering irrigation projects in the national interest, consideration must be given as to where such projects should be located. Federal expenditures for irrigation can be justified only if they result in national benefits.

In dealing with this question, Mr. Roy E. Huffman, Associate Professor of Agricultural Economics for Montana State College, in his paper entitled "Economics of Irrigation," stated:

"In brief, long-term public policy with respect to irrigation development involves determination of *how* much irrigation development there should be, *when* it should be developed, and *where* it should be developed. Unfortunately, it involves the difficult problem of submerging local, sectional, and regional interests each to the larger public

interest. It is necessary, however, to a sound national program for the conservation, development, and use of resources."

It is one of the responsibilities of the Commission to determine whether the proposed South Saskatchewan River Project represents the most profitable and desirable use which can be made of the physical resources involved. In this connection, the Province of Alberta in its submission made to the Commission has suggested an alternative proposal. The proposal submitted by the Province of Alberta suggests the irrigation of certain lands in Alberta by a diversion in that province and the servicing of certain lands in the North Western part of Saskatchewan by such diversion and the extension of the project to service lands that are contained in and part of the South Saskatchewan River Project.

The Alberta proposal requires no further investigation to ascertain if it would be suitable as an alternative project.

A similar proposal has already been considered, studied and rejected as unsound as a project for the servicing of the lands in Central Saskatchewan. It was because of this that the South Saskatchewan River Project was first considered. Years of investigation have resulted in a favourable report on the feasibility of the South Saskatchewan River Project. This project was not only thoroughly investigated by the P.F.R.A. Engineers but outstanding consultants were retained to advise on all aspects of the project. A comprehensive report in great detail has already been made to the government.

The project as proposed by the Province of Alberta, is a project for the utilization of a small part only of the waters of the South Saskatchewan River augmented by the water required for this project by a diversion from the North Saskatchewan River.

With all due respect, it is a submission which is provincial in its outlook and disregards entirely three very important factors, namely:

1. The great loss of water through evaporation and seepage that would result through the operation of a canal, 400 to 500 miles in length.
2. That the average natural annual flow of the South Saskatchewan at the proposed point of diversion in Alberta is only 1,350,000 acre feet as compared to 7,610,000 acre feet at Outlook.
3. That the net loss of water under the Alberta proposal would provide almost the entire irrigation requirements of the South Saskatchewan Project.

The Commission is charged with the responsibility of determining the most profitable and desirable use which can be made of the physical resources involved. Certainly, there is no alternative to the South Saskatchewan River Project which can measure up to the profitable and desirable results which can be obtained from a national point of view. The waters which flow in the South Saskatchewan River are a great national asset. These waters should be utilized to give the greatest possible national benefit to Canada. The Alberta proposal would result in a great part of the waters that flow in the South Saskatchewan River being permitted to run to the sea without rendering to the nation any commercial return. The ultimate development of the South Saskatchewan River Basin will result in the waters of the North Saskatchewan being utilized to service certain lands in Alberta and Saskatchewan, but the entire benefits of the South Saskatchewan River can be realized only by the construction and development of the South Saskatchewan River Project in the Province of Saskatchewan.

The water losses which would result by the construction of an overall Alberta-Saskatchewan development as suggested by the Province of Alberta would be tremendous. It has been estimated that these losses would amount to 1,393,400 acre feet annually. These losses, it will be noted, are as much as the entire flow of the South Saskatchewan River at the point of diversion of the Red Deer River in Alberta, which has been recorded as 1,350,000 acre feet. This means that the waters that are to be actually required for the proposed project must come from the North Saskatchewan River, and, possibly, if sufficient water cannot be obtained from that source, from the Athabasca River. Surely, the waters from these two rivers can be utilized to greater advantage in Alberta and in western Saskatchewan, without being called upon to service lands which can be so easily provided with water from the South Saskatchewan River, which flows right to the place where it is required in Central Saskatchewan. Surely, the water resources of Canada which flow in the North Saskatchewan and in the Athabasca River should not be depleted, and wasted when there is available water in the South Saskatchewan River to the extent of over 5,000,000 acre feet, after providing for all requirements of the Province of Alberta to service their present projects which if not used, will flow to the sea without rendering to this nation the benefits which could accrue through the beneficial use of this great resource.

Irrespective of the great losses that would accrue to the nation as a result of the use of the North Saskatchewan water and the waters of the Athabasca

River as proposed by the Province of Alberta, it is very doubtful indeed if these waters could be economically brought to the place where the water is so badly needed in the central part of the Province of Saskatchewan, or at all. Suffice it to say that the cost of maintaining a canal of 400 to 500 miles in length would be tremendous and the administration and the maintenance of such a canal would present great difficulties and almost unsurmountable problems.

The Alberta proposal fails to use the great part of the waters under reference. It disregards entirely the development and utilization of the South Saskatchewan River Basin. The Alberta proposal would use the entire flow of the South Saskatchewan River at the point of diversion on the Red Deer, but would obtain the greater part of its requirements from the North Saskatchewan River. The amount of water required would be much greater than that required for the South Saskatchewan River Project. In fact, the increased water losses of a combined project would amount to 859,000 acre feet, which would provide almost the entire irrigation requirements of the South Saskatchewan River Project, which amount to 960,000 acre feet.

On the other hand, the South Saskatchewan River Project is the logical step in the development of the entire drainage basin. It does not affect in any way any contemplated development up stream, including the Red Deer Project. At the point of diversion in Alberta the entire average annual flow of the Red Deer River is only 1,350,000 acre feet. This flow remains available to Alberta even after full development of the South Saskatchewan River Project. The South Saskatchewan River Project is a multiple purpose project providing not only irrigation, but power, stream regulation, flood control, an assured domestic water supply, and other uses. It creates a great storage reservoir right in the centre of the dry belt and makes possible, as nothing else could, the stabilization of one of the most depressed areas in Canada. The water resources of the Nation must be developed in such a way as to benefit the entire Nation. Already the economy of the Province of Alberta has been stabilized by reason of the development that has taken place in that Province through the expenditure of Federal moneys. Already the resources of the South Saskatchewan River have been utilized by the Province of Alberta; but in Saskatchewan there has been no development. Saskatchewan is the only place where this development should be made in the interest of the entire nation *at this time*, not only because Saskatchewan needs irrigation but because by giving to Saskatchewan, the use of this great national resource the economy of this part of Canada will be stabilized and the Nation will benefit.

The Saskatchewan River is an interprovincial stream. It flows from Alberta into Saskatchewan and thence to the Province of Manitoba. The resources provided by this great river must be utilized in such a way as to develop all of the territories through which this great river flows. It would be not only unjust to Saskatchewan but detrimental to the nation if part of the waters of this great river were not utilized in the Province of Saskatchewan.

Disputes have arisen, not only between provinces and states but between nations regarding the utilization of waters that are interprovincial or international in character. It is unnecessary that we consider the law which applies to these interprovincial streams, because we have a Prairie Provinces Water Board that allocates the water as between our provinces, but in the United States of America, disputes have arisen between the different states of that great nation as to the use of water and litigation has resulted because of the claims made by one state against another. Their water law there has, however, been definitely settled by litigation and "equitable apportionment" has been the basis for settlement of disputes in that country. In the case of New Jersey versus New York, 283, U.S. 336, 342, Mr. Justice Holmes of the Supreme Court of the United States said this:

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to the destruction of interests of lower states could not be tolerated. And on the other hand equally little could New Jersey be permitted to require New York to give up its power altogether in order that a river might come down to it undiminished. Both states have real and substantial interests in the river that must be reconciled as best they may be. The different traditions and practices in different parts of the country may lead to varying results but the effort always is to secure an equitable apportionment without quibbling over formulas."

The Boundary Waters Treaty between Canada and the United States of America embodies this principal. "Equitable apportionment" was the basic rule behind the division of the St. Mary and Milk Rivers. What is reasonable, right, fair and just must ever be the controlling principle in order to reach the correct solutions of such controversies, not only between provinces but between nations; but more than that, in this case the national interest must prevail, and it is in the national interest that there be justice in determining

the uses of a great national resource and in seeing to it that federal moneys are expended towards the development of a national resource in such a way as to stabilize all parts of the nation and to see that the most profitable and desirable use is made of the physical resources involved.

It is from this point of view that the Prime Minister of our country, The Rt. Honourable Louis St. Laurent, referred to the proposal to build the South Saskatchewan River Project when he spoke in Parliament on the 28th day of June, 1952.

It is respectfully submitted that the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project would be commensurate with the cost thereof, and that the said project represents the most profitable and desirable use which can be made of the physical resources involved.

**Supplementary General Statement presented by
Hon. I. C. Nollelt, Minister of Agriculture in
behalf of the Province of Saskatchewan to the
Royal Commission on the South Saskatchewan
River Project with reference to Alberta's Alter-
native Proposal.**

We greatly regret that the Brief submitted by the Alberta Government was not made available to us until very recently. The matter of analysing and replying to this submission was therefore somewhat impaired because of the limited time available.

The unusual nature of the Brief, and its bearing on the South Saskatchewan Project under review by this Commission, makes it necessary that some general reference be made to this Brief. I therefore wish to make some general observations on this Brief which will be dealt with in greater detail by Mr. Pope, Counsel for the Government of Saskatchewan, and Mr. Scammell, in charge of water administration for the Province of Saskatchewan.

I note the Alberta Brief constantly refers to and deals with the entire Saskatchewan River Basin. It is therefore worthy of mention that the Saskatchewan River as such actually begins at a point some forty miles east of Prince Albert, Saskatchewan, where the two rivers—the North Saskatchewan and the South Saskatchewan—join to become the Saskatchewan River from that point on. The two rivers, by virtue of natural physical circumstances, are two entirely separate

and independent watersheds. This is illustrated by the fact that at their points of entry into Saskatchewan, the two rivers are nearly 200 miles apart.

The terms of reference to this Commission are:

- (i) Whether the economic and social returns to the Canadian people on the investment in the proposed South Saskatchewan River Project (Central Saskatchewan Development) would be commensurate with the cost thereof;
- (ii) Whether the said Project represents the most profitable and desirable use which can be made of the physical resources involved.

It can only be assumed that since the South Saskatchewan River Project is mentioned in the first part of the reference, the second part refers to the natural physical resources of the South Saskatchewan River. This has been, and continues to be, our interpretation of the terms of reference placed before this Commission. This point is emphasized by the fact that by far the greater part of the water resources of the South Saskatchewan River beyond the border of Saskatchewan can only be used to advantage for irrigation in Saskatchewan, and for power both in Saskatchewan and Manitoba; and if these waters are not utilized for these purposes in Saskatchewan they will forever run wasted to the sea.

The Alberta Brief proposes a man-made alternative method of diverting water from the Red Deer River and the head waters of the North Saskatchewan River and hence by a lengthy artificial canal approximately midway between the two rivers at point of entry into Saskatchewan. This proposed canal, which follows a circuitous route where seepage loss will be great, will, it is assumed, irrigate lands alongside a huge natural river with its waters running waste. In our opinion, this proposal as an alternative (and that's what it is—not a combined project, as mentioned in the Alberta Brief) confuses the terms of reference to this Commission and, to say the least, is fantastic as an alternative when compared to the Central Saskatchewan Project envisaged. The alternative proposal does not represent a co-ordinated program of water development for drainage basins but the direct opposite since it ignores entirely the utilization of the main waters of the South Saskatchewan River for irrigation, power, flood control and municipal purposes so greatly required in Saskatchewan.

The two projects, by natural features, are completely separate and should be developed separately. Doing so will not impair the development of either project in any way. Co-ordinated separate development of these projects is in no way affected by an artificial

boundary dividing the drainage area, as mentioned in the Alberta Brief. Again, the direct opposite is the case because, as intended by nature, the South Saskatchewan River flows unimpeded across this artificial boundary. The principal question to be decided is: Will this water in this drainage basin, flowing across an artificial boundary, remain unutilized and wasted forever because of an artificial boundary dividing the drainage areas? To propose a man-made alternative would have this precise effect.

The alternative proposal ignores entirely the use of a large body of water in a natural drainage basin. This is also the direct opposite to any co-ordinated program for basin development. This line of thinking indicates that an artificial boundary dividing two government jurisdictions has some influence towards preventing or stalling the development of natural drainage basins. The alternative project is clearly inconsistent with a co-ordinated program of basin development. Wherever possible, waters within such natural drainage basins should first be utilized before trying to do what nature did not do by resorting to artificial alternatives to natural drainage areas.

We are not opposed to two separate projects. In fact, we are greatly interested in any additional irrigation that might be made possible in Saskatchewan as a result of further studies being made of the Alberta proposal as a separate project. We do maintain, however, that these further studies should not occasion any delay in proceeding with the Central Saskatchewan Development Project because this project represents the greatest possible national benefit to be derived from the physical resources involved. The detailed reasons for our attitude in this regard will be presented by Mr. Pope and Mr. Scammell.

In our Brief, already submitted, we have pointed up the urgent need for immediate development in Saskatchewan. The suggestion contained in the Alberta Brief, that the Project be delayed for further study, will occasion some surprise and disappointment to the many people in Canada who support this Project. It is noteworthy that, by comparison, Alberta has already received an allocation of water through the Inter-provincial Board of 1,256,000 acres against an allocation to Saskatchewan of 30,000 acres, and has, in addition, already received extensive assistance from the Federal Government for irrigation development on large projects. The Alberta Brief states that 1,721,400 irrigable acres are allowed for in Alberta, and then follows with the amazing statement that the Province of Alberta can give no assurance that irrigation development in that province will be confined to that acreage. It is encouraging to note that people now generally

consider that on the basis of need and urgency, development of the South Saskatchewan Project cannot be postponed any longer.

It is particularly heartening to note that there are public men in Alberta who take an entirely different viewpoint in support of this Project. For example, on Page 3946 of the House of Commons' *Hansard* for June 28, 1952, Solon Low is quoted as follows:

"Mr. Chairman, I think this has been the finest debate I have heard in this house on the subject of the South Saskatchewan river project. I was delighted to hear both the leader of the opposition and the right hon. Prime Minister express views on the subject tonight. It seems to me that in their cogent statements can be found great comfort and hope for the people, not only of Saskatchewan but of all Canada, who have been wanting to see this great project completed at the earliest possible time."

A further quotation from Solon Low's remarks in the House of Commons, appearing on Page 3947 of the *Hansard* of June 28, 1952, is as follows:

"There is just one thing I would like to say by way of encouragement to my friends in Saskatchewan. I want to see Saskatchewan get that project on the South Saskatchewan river as quickly as they can because I know what it will do for their province and for the rest of Canada as a whole. We in the province of Alberta have recognized so fully the value of that project to Saskatchewan and to the west that we have been prepared for some years to share our waters that rise on the eastern slopes of the Rockies in our province. We have already arranged that allocation of water through an agreement made with the federal government in 1948."

Unfortunately, this is incorrect. An allocation to this project has not yet been made—and in a few moments I will present the reasons why we have not received an allocation. I should mention that Mr. Low went on to point up the great handicaps in Saskatchewan towards carrying the burden of public services in a province of great distances and low-carrying capacity. He mentioned that the provincial burden of financial contribution for this national development project should be less in Saskatchewan than in Alberta because for many years Saskatchewan has been shouldering a heavy burden of cost as a consequence of Dominion settlement policies prior to and after 1931 when the resources were handed over to this province. The

observations of Mr. Low are very encouraging and are in direct contrast to the viewpoints expressed by other public men in Alberta.

The remarks of Mr. Blackmore, M.P., House of Commons, in the same debate, which appears on Page 3956 of the *Hansard* of June 28, 1952, are also worthy of quotation:

"Alberta by good fortune, because of the resources she has, has been placed in a better position financially than Saskatchewan. In my judgment Saskatchewan has done the very best she could with the resources at her disposal. The Minister of Agriculture knows, better than any other person in Canada, how meagre those financial resources are compared with the tremendous responsibilities that rest upon the government of Saskatchewan. I believe the minister will bear me out in that.

"I thought it well to make those three or four comments before closing, just to reinforce what the hon. member for Peace River said. I shall back the member for Peace River every inch of the way. I too do not believe that it is in any degree fair to the people of Saskatchewan to ask them to assume half the cost of building this great irrigation project.

"I should like also to express appreciation to all the members who have participated in this debate. I believe that as a result of this debate it will be made easier for the minister to get the support from all over Canada which he ought to have. As a result of bringing together the support from all of Canada, we shall be able to get this great project completed at an early date and put what we might call the capstone on these irrigation projects as well. This would show our intention, as a nation, to reimburse to some extent at least the people who have settled in that area of the Palliser triangle."

Now I wish to quote from Paragraph 4, Page 7, of the Alberta Summary Brief, as follows:

"The Alberta government believes that until a thorough investigation of one overall Alberta-Saskatchewan Project has been completed, the best uses of the water reservoirs of the Saskatchewan River drainage basin cannot be determined, and they would suggest that such an investigation be initiated by the Prairie Provinces Water Board."

I note, particularly, the suggestion to the Commission that a further study of the combined projects be referred to the Prairie Provinces Water Board. I wish to state in this connection that this matter, at

the suggestion of Alberta's representative on the Prairie Provinces Water Board, has already been referred for study to the Prairie Provinces Water Board and a report submitted by that Board. A copy of this report and minutes of this meeting will be filed for the information of the Commission by Mr. Pope and Mr. Scammell in view of the representations made by Alberta that a further inquiry by the Prairie Provinces Water Board be undertaken. There was also correspondence which I had with Mr. Ure and Mr. Gardiner, and I attach copy of this correspondence to this statement for the information of the Commission. I mention this because, when the Saskatchewan representative on the Board, Mr. Scammell, during the Water Board meeting of September 5 and 6, 1951, moved that in view of the information received and of the fact that the necessary water was available, the Board now recommend an allocation to this project. However, two representatives on the Board—Mr. Hogarth and Mr. Farr—felt that the Board should wait until they had received the report of the Royal Commission (newly appointed at that time) and to treat the Commission's report as additional evidence. Alberta's representative, the minutes of the meeting reveal, agreed with this view but added that the alternative combined project should be looked into, preferably by the Royal Commission. It is most interesting, therefore, to note the suggestion now made to the Commission that the Prairie Provinces Water Board initiate still another investigation.

We are certainly not against, but favour, any further useful studies that might be required to make greater use of our water resources to the benefit of the provinces concerned. However, we are very much opposed to any attempt to directly or indirectly delay or stall this urgently required irrigation and power project in Saskatchewan. We are quite certain that in light of the evidence that we have already submitted, any attempt to do so is not in the national interest or in the interest of the provinces concerned.

We do not agree at all that the alternative proposal would be less costly. Indeed, careful scrutiny of costs balanced against benefits indicate that the alternative would be much more costly from the point of view of original cost, maintenance and loss of irrigation and resource power energy that could not be made up in any other way. It is also clearly evident that if the alternative project were proceeded with, the water supply would be most uncertain and would relegate Saskatchewan to the position of a "tailender". It is borne out by irrigation experience that water users at the end of the ditch in years of low flow often look in vain for water when needed. Saskatchewan does not

relish the thought of being a "tailender" in any irrigation scheme when a large volume of water by natural flow is so readily available. A thin, man-made water lifeline is against all principles of successful irrigation. For irrigation to be successful and justify investment, an ample water supply must be beyond question. A good illustration might be found in the diversion ditch constructed as a source of water supply for the City of Moose Jaw. This emergency source of water supply by artificial canal has been made famous for the little water it actually carries to the reservoir basin—a maximum of 40 per cent of the water pumped into this ditch actually reaches the reservoir. I am informed that the cost of loss of water by seepage in the proposed canal would offset any pumping costs associated with the Central Saskatchewan Development. We submit that it is not in the public interest to expose a costly irrigation project to man-made hazards. We would therefore suggest that the Alberta proposal does not represent the most profitable and desirable use of the physical resources involved.

In regard to the need for pumping at the South Saskatchewan dam site, the Alberta Summary Brief, on Page 2, Paragraph 1, states:

"For some time to come and possibly forever, the construction of irrigation facilities should be confined to those areas which can be reached by gravity canals or by low lift pumps, where exceptional conditions warrant the use of such pumps."

In other words, only those lands that can be reached by low lift pumps or gravity should be irrigated. Alberta has 700,000 acres still to be developed on this basis, and says, in effect, "Saskatchewan should continue to experience all the hazards of drought until these acres are developed". And, perhaps not even then, I take it, even though the alternative proposal is not feasible!

We maintain that it is much more costly and uneconomic to divert water great distances than it is to pump from a large natural reservoir where only a minimum of the power made available is required for pumping. However, by contrast to the above viewpoint, is the further observation made in the last paragraph on Page 4 of the Alberta Summary Brief, which states:

"The point to be noted, however, is that all irrigable lands provided for in Alberta are or can be, and should be, under gravity canals, but if it can be considered economically feasible to pump water to great heights for the irrigation of lands in Saskatchewan, then it must be even more feasible and economical to pump water to the same great heights for lands in Alberta."

This is a surprising statement because, in the first instance, the South Saskatchewan Project is condemned because pumping is involved. The second statement suggests that if it can be done in Saskatchewan, it would be even more feasible and economical to pump water in Alberta. It is surprising how economic things can become in Alberta in the minds of some people. These contradictory viewpoints greatly weaken the objections raised to the South Saskatchewan Project. This merely seems to be "me too-ism" carried to an extreme.

It is well, also, to be reminded that where a great need is manifest at a given point on a natural drainage basin and physical features for a large dam and storage reservoir make possible a multi-purpose project providing irrigation, flood control, municipal and industrial water supply and abundant electrical power possibilities both at the site and down stream, then, surely to Heaven, the commonsense of a layman understands that using a minimum of that power for irrigation pumping is feasible and the proper thing to do. We know that gravity irrigation is desirable, but if you haven't got it at the point of greater need, you haven't got it, and we should not be denied use of South Saskatchewan River waters because someone else can irrigate by gravity flow. The accepted criterion of national investment is predicated on the national benefits that can be derived from the development of physical resources and those national benefits are greatest where the national liability of need is the greater. We hold that the greatest national benefits accrue to the Central Saskatchewan Development.

Equitable Apportionment of Inter-provincial Streams

As a result of the artificial boundary separating Canada and the United States, the principle of equitable apportionment of water resources flowing from one country to another is accepted as a legal right. No province is more greatly concerned that this principle be adhered to than is the Province of Alberta. We feel that since the provinces have been granted ownership of water resources by agreement with the Dominion Government, the principle of equitable apportionment on the basis of need and beneficial use should also apply to waters flowing across provincial boundaries. It is a fact that water resources do flow across artificial boundaries, and it is also a fact that artificial boundaries define separate governmental jurisdictions and such jurisdictions imply responsibilities for public services at all levels, both provincial and municipal. Standards of services and standards of living for people within such jurisdictions are also involved, for which federal, provincial and local governments have a direct responsibility. Because of this, provinces have certain

recognized fundamental rights to share in the benefits of water resources development on streams flowing across provincial boundaries! The fact that artificial boundaries were created, rather than argue against argue for the South Saskatchewan Project. This does not mean that a co-ordinated program of basin development will be impaired, but it does mean that such a program must be devised to permit a sharing of benefits as far as physically possible as an accepted guiding principle. To approach the matter in any other way would permit greatest benefits to areas most fortunately situated because of natural features. Such an approach, if accepted, would result in permanently depressed areas starved by the lack of resources development and a continued liability to the rest of the nation. We again reiterate that the most profitable and desirable use of physical resources can best be attained by accepting the principle, wherever possible, of equitable apportionment of water on the basis of need and beneficial use.

In summary, may I briefly set out the following points:

1. The two projects by natural features are independent and completely separate developments and no delay in proceeding with the South Saskatchewan Project should be occasioned by further studies regarding possible diversions from the North Saskatchewan watershed.
2. Separate development is consistent with and has all the advantages of a co-ordinated programme of water utilization for the drainage basins.
3. Separate development implies full utilization and use of drainage basin waters for power and irrigation throughout the entire basin.
4. The combined alternative project would result in the failure to utilize some 5 million acre feet of water annually. This waste is absolute and cannot be made up by alternative diversion and represents a loss of millions of dollars annually in waste resources. This water waste represents power and irrigation losses to Saskatchewan and Manitoba.
5. The South Saskatchewan Project will increase the irrigation and power potential of the two river basins.
6. It is not necessary or practical to divert water for the Saskatchewan Project.
7. Natural stream flow available in the South Saskatchewan River should first be developed before diversions are considered.
8. Pumping at the dam site where surplus power is readily available is preferable to uncertain and costly alternative diversions.

9. Finally, the proposed combined alternative project is not a practical alternative because of physical features, cost of construction and maintenance of a long canal, plus loss of water by seepage and questionable supply for irrigation, plus a further cost to replace lost power at the proposed dam site and the benefits of more economic power down stream. The loss of abundant cheap water for municipal supply, particularly to the Cities of Moose Jaw and Regina, cannot be overlooked. The added annual cost of pumping from the present river level would be a continuing financial cost to the national government.

We are sure that the Commission will carefully consider these factors relating to the most profitable and desirable use which can be made of the physical resources involved.

[DOCUMENTS FILED]

REGINA, October 26, 1951.

Dear Mr. Ure:

I have received the minutes of the meeting of the Prairie Provinces Water Board held in Regina on September 5 and 6, 1951. Apparently there are several matters arising out of these minutes requiring inter-governmental correspondence.

Firstly, there is the question raised by the Alberta representative with respect to an alternative development to the South Saskatchewan Project. In my opinion this suggestion should not have been admitted for discussion since it is not really an alternative but an entirely separate and separable project which should have been considered *after* a decision on Saskatchewan's request had been made. This is in keeping with established procedures of the Board. Assuming, as the Board did, that the North Saskatchewan project is an alternative, we now have a report from the Board's Office (Report No. 4, Prairie Provinces Water Board) indicating clearly that it is not a desirable alternative to the South Saskatchewan Scheme as now constituted. I trust that this report is satisfactory to both you and the Manitoba Government, thus permitting early reconsideration of our proposal.

Secondly, Minute 7-16 of the meeting requested clarification of the Board's terms of reference by the participating governments. The question of the Board's terms of reference apparently centered around the relation of the Board to the recently constituted Royal Commission. As you know, the Board, with the exception of the Saskatchewan representative,

voted to postpone a decision on the allocation until the Commission completes its report to the Federal Government, thus binding itself to the findings of that Commission. In my opinion, this constitutes a breach of the spirit and terms of reference. The Water Board itself was constituted as the central planning agency for the utilization of water resources in the Prairie Provinces. It can undertake the widest possible investigation of the use of inter-provincial streams, employing the most expert advice in that task. In the case of the South Saskatchewan Project, it has done this to the satisfaction of my government. It has, I feel, determined that the construction of this project will afford the most effective use of the waters involved without prejudice to either Alberta or Manitoba. With this in mind, it is entirely unnecessary and improper for the Board to place itself in any subservient position to another investigating group employing other experts in the same task. Furthermore, the Water Board has the specific task of allocating waters on the basis of comprehensive consideration of the factors involved, while the Commission was set up to investigate factors employing eventual investment decisions on the part of the Federal Government.

The position of this Government, with respect to terms of reference, may best be stated by direct reference to Clause 2 of the Agreement setting up the Board, which states:

"2. The functions of the Board shall be to recommend the best use to be made of inter-provincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta and to recommend the allocation of water as between each such province of streams flowing from one province into another province."

In short, a more rigorous application of the present terms of reference and agreed procedures is suggested. I might add that I discussed these problems with Mr. Gardiner in Ottawa recently and he is in complete agreement with the above views.

I would appreciate an early reply to this letter since my government wishes to request an immediate reconvening of the Board to arrive at a final and, I trust, favourable decision with respect to the South Saskatchewan Project.

Yours sincerely,

I. C. NOLLET.

Hon. D. A. Ure,
Minister of Agriculture,
Edmonton, Alberta.

c.c. Rt. Hon. J. G. Gardiner
Dr. L. B. Thomson

MINISTER OF AGRICULTURE, ALBERTA

Parliament Building,
Edmonton, Alberta,
November 10th, 1951.

Honourable I. C. Nollet,
Minister of Agriculture,
Regina, Saskatchewan.

Dear Mr. Nollet:

I have your letter of October 26 last with respect to matters arising out of the minutes of the Prairie Provinces Water Board meeting of September 5 and 6, 1951.

I am not familiar with the established procedures of the Board. However, I should think that in considering an important matter such as an allocation of water for the proposed South Saskatchewan Project, it should be the duty of the Board to consider and discuss all possible plans for the best use of this water. With regard to Report No. 4 Prairie Provinces Water Board, our representative on the Board has recently reviewed this and does not agree that it indicates clearly that a combined Alberta-Saskatchewan development is not a desirable alternative to the proposed South Saskatchewan Project as now contemplated.

With respect to Minute 7-16 and the Board's terms of reference, this has already been considered here. It is the unanimous opinion of Council that the terms of reference must, of necessity, include a study of the most beneficial use that can be made of the water. I agree with you that the Water Board was constituted as a central planning agency with authority to employ expert advice in connection with its investigation, but I cannot agree that it constitutes a breach of the spirit and terms of reference for the Board to profit by the report of a Royal Commission set up to further investigate the South Saskatchewan Project.

It is noted that you suggest a more rigorous application of Section 2 of the terms of reference.

You will remember that this clause was very carefully reviewed by the respective Governments which were parties to the Agreement setting up the Prairie Provinces Water Board, and that it was Mr. Gardiner's view that the Board should itself be responsible for allocations.

It was the opinion of the Alberta Government that the Water Board should function in an advisory capacity only. This is still the opinion of my Government.

Yours very truly,

D. A. URE,

*Minister in Charge of
Water Resources & Irrigation.*

MINISTER OF AGRICULTURE
CANADA

Ottawa, Jan. 14, 1952.

Hon. I. C. Nollet,
Minister of Agriculture,
Regina, Saskatchewan.

Dear Mr. Nollet:

I received a copy of your letter of October 26th written to the opposite Ministers in Alberta and Manitoba with regard to the question involved in the submission of the South Saskatchewan River Project to the Prairie Provinces Water Board.

My own point of view is that the authority given to the Board to study alternative uses of water resources had no particular project in mind. It was intended that there was nothing to prevent this Board making any kind of study it wished to make with regard to the utilization of water and make any recommendations it cared to make to the different governments concerned. I do not think, however, that it was ever anticipated that it would be the responsibility of any province desiring to use water which had been assigned to it to first submit their plans to the Water Board.

My understanding was that the important task of the Water Board was that indicated in the second part of the subsection to the effect that the amount of water to which a province was entitled from any stream which was interprovincial should be recommended and, if agreed upon by the governments concerned, should be established as the amount of water which could flow out of the Province of Alberta into the Province of Saskatchewan and eventually out the Province of Saskatchewan into the Province of Manitoba, and that any quantity which formed a difference between those two amounts could be utilized by the province concerned so long as they did provide that the average flow was to be allowed to pass annually from one province into another.

I do not think it was ever anticipated that the Board had the right to determine for the Government of Alberta or the Government of Saskatchewan or the Government of Manitoba what should be done with the water while it was within their boundaries. In other words, I do not think it was ever necessary for anyone to refer the South Saskatchewan Project as such to the Prairie Provinces Water Board in order to obtain authority to proceed with the South Saskatchewan River Project. For that reason I cannot see how appointment of a committee by the Federal Government to report upon the engineering which had been done under P.F.R.A. should in any way affect the decision of the Water Board as to how much water

Saskatchewan was entitled to out of the flow of the South Saskatchewan River any more than they would have been asked to determine whether we should have built the St. Mary's River Dam or whether in turn we should build a storage dam in the Province of Manitoba if we were asked to do so.

All we would be concerned about in a matter of that kind is the question as to whether the amount of water which the Board had agreed any one of the provinces was entitled to would take care of the project that we ourselves intended to finance. In my opinion, the question as to whether we are going to finance it or not is one to be decided by the Government of Canada and the Government of Canada would be quite capable of determining from the facts given to it by the Prairie Provinces Water Board as to whether there is sufficient water available.

If anyone is going to experience any difficulty as a result of that decision not being made, it will be the committee that was appointed by the Federal Government to check the records. There could be no difficulty experienced by the Water Board because of the fact that the Committee had not yet made its report. In short, I do not think that the procedure followed by the Water Board at their last meeting was in agreement with the terms of the Order in Council which set up the Prairie Provinces Water Board.

I am very much in agreement with the position which you took in your letter to the other Ministers and am sending a copy of this letter to Mr. McDiarmid and Mr. Ure.

I cannot think that they would be interested in preventing an expenditure of money on the part of the Federal Government. My experience has been that all provincial ministers have been attempting to persuade the Federal Government to spend all the money they can get out of them in their particular provinces. It might be a pleasing experience to find that a Board that was set up at the request of the provinces is going to function to stop the Federal Government from spending money in the provinces, but I had scarcely expected that that would be the result.

Yours sincerely,

JAMES G. GARDINER.

Regina,

January 23, 1952.

Dear Mr. Ure:

I have your letter of November 10th, last, replying to mine of October 26th, regarding certain matters arising out of the Minutes of the Prairie Provinces Water

Board Meeting of September 5th and 6th, last. I now also have a letter from the Rt. Hon. J. G. Gardiner in which he comments on my letter of October 26th to you.

Your letter suggests that the alternative proposal submitted by Mr. Russell was something new and had not been given any study or consideration before. The Russell proposal is merely a part of the original Pearce Project, first investigated by the Federal Government in 1921-23 and later by P.F.R.A. Engineer, Mr. Hawkins, and by Mr. Russell himself. Reports of these investigations have been available to us because of the conclusions arrived at, particularly by Mr. Hawkins and Mr. Russell, that the South Saskatchewan River Project was the most economical use of water, we proceeded to go ahead with that project at this time. We have no objection to the ultimate development of the original proposal, which would include an additional 500,000 acres of irrigable land in Saskatchewan, but our first thought is to make the most beneficial use of the water available on the most suitable lands for irrigation.

The South Saskatchewan River Storage places the water supply right in the midst of lands which it has been reported are of better quality and more suited topographically than any other lands in the Pearce Project. Also greater reserve supply and water control is provided by the South Saskatchewan River Storage.

With the lengthy canals to transport the water under the alternative project and approximately twice the surface reservoir areas, with only about one quarter the storage capacity, about 645,000 acre feet of water would be saved annually by construction of the South Saskatchewan River Project.

I therefore cannot agree that alternative proposals have not been thoroughly investigated. Several very competent engineers have gone into the whole question of the development of both the North and South Saskatchewan River waters, and all, including Mr. Russell, have arrived at the conclusion that it is more economical to utilize the South Saskatchewan River as a source of supply for the irrigation of the lands in Saskatchewan.

Mr. Russell presented nothing in his proposal that was not already available to the Board and which was sufficient to enable it to assess the comparative values of alternative uses of the water.

I wish to again state our position in this matter by pointing out the following:

1. That in my opinion there was sufficient material available for the Board to carry out its functions in accordance with Article 2 of the Agreement and to recommend allocation of water for the South Saskatchewan River Project;

2. That, in accordance with the procedures established by the Board at its meeting in Regina on May 6, 1949, the Board should not permit the introduction of any new proposals until it has disposed of the one it already has before it. My opinion on this point has been supported by the Chairman of the Board, by Mr. Gardiner of Ottawa, and by Mr. McDiarmid of Manitoba;
3. That the Board should not accept any proposals for new or alternative projects unless properly requested by one of the Governments of the Agreement. Mr. Russell's alternative, according to his own statement, was submitted to the Board Meeting without the knowledge or endorsement of his Government;
4. That we have no objection to the ultimate development of the North Saskatchewan-Red Deer Project, but not as an alternative to the South Saskatchewan River Project; and further, that the development of the South Saskatchewan Project is not inconsistent with the development of the Basin as a whole, as indicated in Report No. 3 of the Prairie Provinces Water Board;
5. That, *after a thorough and complete investigation has been made of the water resources of a stream*, as reports show was done in connection with the South Saskatchewan River, the Board, to be of any value, should be capable of making its own decision without depending on the findings of other agencies, such as the Commission, that has recently been appointed to investigate the South Saskatchewan River Project purely from the viewpoint of investment therein by the Federal Government. In Mr. Gardiner's letter to myself, dated January 14, 1952, he concurs in this viewpoint. Furthermore, Mr. Gardiner mentions in his letter that the Commission may experience some difficulty as a result of an allocation to the South Saskatchewan River Project not being made;
6. That the Board has already agreed that there is sufficient water for the South Saskatchewan Project without in any way affecting similar projects in other provinces.

This shelving of responsibility could create a precedent for all future actions by the Board. In such an event the prestige of the Board would be greatly weakened and it will defeat the object for which it was established.

I want to again express my Government's wishes that the Board reconvene at a convenient date and

reconsider its decision on the South Saskatchewan Project, and I suggest that when it meets the Board Members adhere more closely to the terms of the reference which are quite clear to my Government as outlined in the foregoing.

With reference to your expression of opinion, contained in the last paragraph of your letter of November 10th, that the Board should function in an advisory capacity only, this has not been borne out in actual practice. The Board, under the agreement signed by the four governments, is authorized to, and has made recommendations to the respective governments, all the recommendations for allocation, excepting for the South Saskatchewan Project, have now been concurred in by the governments concerned. I am now hopeful of similar favourable consideration by the Board for a recommended allocation to the South Saskatchewan Project.

I am also writing to Hon. J. S. McDiarmid in this same regard and am forwarding a copy of this correspondence to him as well as to Dr. L. D. Thomson for their information.

Trusting that I may hear from you as soon as conveniently possible, I remain,

Yours sincerely,

I. C. NOLLET.

Hon. D. A. Ure,
Minister of Agriculture,
Edmonton, Alberta.

MINISTER OF AGRICULTURE
ALBERTA

Parliament Building,
Edmonton Alberta,
February 6th, 1952.

Hon. I. C. Nollet,
Minister of Agriculture,
Regina, Saskatchewan.

Dear Mr. Nollet:

I have noted the contents of your recent letter dealing with the matter of Prairie Provinces Water Board. I note that you have outlined your position under six headings; I would like to briefly comment on some of them.

You admit that No. 1 is only your opinion which would leave room to suggest that others might have an entirely different opinion on the same question. If all the Board had to do was allocate water, its function would not be too onerous.

Royal Commission on South Saskatchewan River

2. Certainly we could not agree with your idea that no new proposal could be introduced until the one before the Board was already disposed of. This is something that we would never agree with. It could be a means of stalling unnecessarily.

3. I can quite appreciate that Mr. Russell was not taking it upon himself to speak for the Government of this Province at the Board meeting referred to. However, as I think I have indicated to you before, the views expressed by Mr. Russell are those held by the Government here.

Further on in your letter you suggest that the Board, to be of any value, should be capable of making

its own decisions. As far as we are concerned, the Board does not make any decisions. It only makes recommendations. Any decisions that will be made, as far as we are concerned, will be done by the Executive Council.

I trust that this indicates quite clearly our thinking on these matters.

Yours very truly,

D. A. URE,
*Minister in Charge of
Water Resources and Irrigation.*

PROVINCE OF ALBERTA

Copy

April 9, 1952.

Dr. T. H. Hogg,
Chairman, Royal Commission,
South Saskatchewan River Development,
Ottawa, Ontario.

My Dear Dr. Hogg:

With regard to the matters contained in your letter of December 19, 1951, and particularly with regard to the last paragraph of that letter, my Government has now prepared a written submission which we trust will help the Commission's inquiry.

The submission expresses very briefly some of the views of my Government in advance of public hearings to be held later, and is not intended to preclude a formal submission by the Government of Alberta at a public hearing.

Yours very truly,

E. C. MANNING,
Premier.

INTRODUCTION

In order to properly present the views of the Alberta Government with respect to the proposed South Saskatchewan Development having regard to whether the said project represents the most profitable and desirable use which can be made of the physical resources involved it has been necessary to review the

proposals and plans which have been investigated over the past thirty years in connection with such a project. The following are briefly discussed:

First: Characteristics of the Saskatchewan River drainage basin and of the main tributaries of the North and South Saskatchewan Rivers.

Second: Jurisdiction over the administration of interprovincial streams.

Third: Interprovincial Board.

Fourth: Dominion Provincial Board.

Fifth: Activities of the Water Board.

Sixth: Analysis of alternative plans for use of the physical resources involved.

Seventh: Further investigations suggested.

NOTE: For the convenience of the Commission the views of the Alberta Government are summarized at the beginning of the submission.

Summary

Because the headwaters of the important interprovincial streams are in the mountains and foothills of Alberta where the bulk of the runoff is readily accessible and feasible to divert, this province has not been so concerned as to the jurisdiction over the waters of such streams as have the provinces of Saskatchewan and Manitoba. However, in the best interests of the best uses of these waters, the Government of Alberta has agreed to the establishment of a Dominion-Provincial Board for the purpose of advising the respective Governments, first, with respect to the extent and character of the water resources of the interprovincial streams and the affects of the existing and potential water develop-

ments in any one of the provinces upon the water development potentialities of the other two provinces and, second, to recommend to the respective governments concerned, the allocation of waters of streams in the drainage basin for projects and provinces having regard to the best use of water in the drainage basin as a whole.

Because the conservation and the best use of inter-provincial streams in the Saskatchewan River drainage basin, can only be attained through the regulation of the flow of the streams by storage, and because the natural and artificial storage sites are in the mountain and foothill regions of the drainage basin, it is not possible to administer the water resources of this basin in the best interests of the respective provinces except through single administrative authority. In other words, these interprovincial streams cannot be administered in the best interests of the most beneficial use of water by the respective provinces separately.

Because of topographic and other features of the Saskatchewan River drainage basin, the best or most economical and beneficial uses of the water supplies, so far as irrigation and water power development is concerned, naturally occur in the foothill reaches of the drainage basin. This foothill region happens to be in the province of Alberta.

Although there is a very extensive area of semi-arid lands, within the Saskatchewan River drainage basin, which will benefit by the application of water for irrigation, stock water and other domestic purposes, particularly if pumping is resorted to, there is a definite limit to the quantity of water which it is feasible or economical to divert for these lands. For some time to come and possibly forever, the construction of irrigation facilities should be confined to those areas which can be reached by gravity canals or by low lift pumps, where exceptional conditions warrant, the use of such pumps.

It is possible, by diversions in the foothill regions of the Saskatchewan River drainage basin, to divert and carry irrigation water from the Red Deer, Clearwater, North Saskatchewan River, and if need be, from the Athabaska River, to large areas of semi-arid lands in both Alberta and Saskatchewan. Such a project was first investigated in a preliminary way by the Dominion Reclamation Service in the years 1921-22, and found to be quite feasible. However, a number of alternative plans to divert water to the lands of Alberta and Saskatchewan have since been investigated in some detail, but no surveys in detail have yet been made of one overall development for lands in both provinces.

Some of the advantages of two separate projects for Alberta and Saskatchewan are as follows:

- (1) It enables the province of Saskatchewan to proceed with irrigation development independent of the province of Alberta.
- (2) It brings the point of diversion for lands in Saskatchewan closer to these lands thus saving some losses in water transportation and some maintenance costs.
- (3) A dam on the South Saskatchewan River could serve as a diversion for water for irrigation purposes and also as a water power development for the generation of power for industry in Saskatchewan.
- (4) The proposed location for a reservoir on the South Saskatchewan River is such that little property damage would result from flooding.
- (5) The Calgary Power Limited, for its operations on the Bow River, has constructed a number of reservoirs which have the effect of increasing the winter flow of the South Saskatchewan and Saskatchewan Rivers through the province of Saskatchewan and Manitoba, thereby increasing the firm water power capacities of these streams.

Factors in favour of one overall Alberta-Saskatchewan Development are as follows:

There is always an advantage in co-ordinated programs of water development for drainage basins. The programs for the development of any particular drainage basin, in order to be economical, should be comprehensive and co-ordinate all individual effort with the end in view that the most beneficial use is made of the available water supply for the ultimate development. The independent development of the water resources mainly because of an artificial boundary dividing the drainage area is not consistent with the principles above enunciated.

For the full development of irrigation and water power in the Saskatchewan River drainage basin, both the North and South Saskatchewan Rivers are necessary. Insofar as irrigation is concerned the North Saskatchewan River is of little value except for the possibility of diverting some of the water from it to the South Saskatchewan River. The only point where such a diversion can be made happens to be in Alberta. Unless such a diversion is made to supplement the flow of the South Saskatchewan River, there will not be sufficient water available from the South Saskatchewan River for a reasonable water power and irrigation development.

There is more likelihood of finding good foundation conditions for diversion structures in Alberta than in Saskatchewan and the magnitude and cost of such structures will be much less in Alberta than in Saskatchewan.

Fairly complete water supply estimates of the Saskatchewan River drainage basin indicate that after allowing for some 1,721,400 irrigable acres in Alberta, there is sufficient water left for Saskatchewan.

- (a) To satisfy all future requirements along the Qu'Appelle Valley.
- (b) To irrigate over 430,000 acres of land every year in Saskatchewan.
- (c) To produce all of the energy necessary to pump the necessary supply for the irrigable lands.
- (d) To produce 326,000,000 K.W. hrs. of firm commercial energy each year.
- (e) To produce average per year 100,000,000 K.W. hrs. of secondary energy.

The doubtful part of the calculations to arrive at the above conclusions are with respect to return flow, evaporation losses and estimated requirements for irrigable areas. However, the estimates are reasonably close. The point to be noted however, is that all irrigable lands provided for in Alberta are or can be, and should be, under gravity canals, but if it can be considered economically feasible to pump water to great heights for the irrigation of lands in Saskatchewan, then it must be even more feasible and economical to pump water to the same great heights for lands in Alberta. Since, however, there are far more lands in the drainage basin than there is water available to irrigate, then it would be very wise to confine irrigation development in the drainage basin to those areas which can be reached by gravity canals rather than the lands which require to be reached by pumps.

If, for instance, the irrigable lands in Alberta were re-estimated on the basis of even a fifty foot lift, the water supply estimates would show considerably less firm and secondary energy than now estimated available at the Coteau site in Saskatchewan. That is, since the province of Alberta can give no assurance that irrigation development in the Province will be confined to 1,721,400 acres, then the estimates made for the primary and secondary energy production for the Coteau site is questionable on the basis of water supply alone.

If, by the construction of a dam in Saskatchewan of some reasonable height and cost, the South Saskatchewan River could be diverted by gravity canals to the Saskatchewan lands requiring water at costs comparable with the cost of carrying a similar supply of water from Alberta to these same lands then, and only

then, should two separate developments be considered, not because of any artificial boundary such as the fourth meridian, but as a matter of economy. The following are the best estimates available at the present time from which to judge the comparative merits of the proposed combined and separate developments.

On the basis of capital cost for the irrigation facilities to irrigate, in Alberta, some 400,000 acres of land, and in Saskatchewan some 430,000 acres of land, the following are the comparative costs.

Separate developments	\$134,000,000.00
Combined developments ...	96,367,000.00
Difference	\$ 37,633,000.00

Assuming a difference of some \$38,000,000.00 in favour of the combined irrigation project then for comparable costs it is necessary to justify the expenditure of some \$38,000,000.00 by revenues to the irrigation development from the operation of the power development.

The following is from the report of David Cass-Beggs, the consulting engineer employed by the Government of Saskatchewan to investigate the water power possibilities on the proposed South Saskatchewan project.

"The primary disadvantage of the Coteau Creek plant is the limited energy available, particularly at the end of the irrigation development.

"The available energy has been estimated to be 326,000,000 Kw. hrs. initially falling to 210,000,000 Kw. hrs. finally. These figures are nearly 100,000,000 Kw. hrs. less than those estimated by the P.F.R.A.

"If the P.F.R.A. figures were realized at the start of the project it would probably be difficult to use the energy but at any time after 1970 an additional 100,000,000 Kw. hrs. could be absorbed and could be valued at 3.5 mills since it would save the incremental energy cost to this extent and the capital costs of transmission would already have been covered by the first block of energy.

"It would appear possible to contribute to the Central Saskatchewan project in one way or another a sum equal to the value of any additional power available, say 3.5 mills per Kw. hr., up to 100,000,000 Kw. hrs. per year. If the P.F.R.A. estimates were to be realized this would provide an income of \$350,000 per year after 1970. The assumptions on which this report is based indicate that it would be available only in occasional years or periods of high flow."

It would appear that there would not be much hope of justifying an expenditure of \$38,000,000.00 by power revenues particularly if such revenues would not be made available until after the year 1970.

The power and irrigation facilities are so tied together and involved, in this particular proposal, that it is very difficult to separate them in order to get a true picture of the values of the two separate developments. However, because of the uncertainty as to the future power loads for the Province and also of the water supply which will be available ultimately for power production, for these reasons alone one overall Alberta-Saskatchewan development would appear to be in the best interests of the drainage basin as a whole.

It is the view of the Alberta Government that the terms of reference to the Prairie Provinces Water Board must of necessity include a study of the most beneficial use of water and that a reservation of water for a two year period, which has been made by the Board, is all that is warranted under present circumstances for the South Saskatchewan River Project.

The Alberta Government believes that until a thorough investigation of one overall Alberta-Saskatchewan Project has been completed, the best uses of the water reservoirs of the Saskatchewan River drainage basin cannot be determined, and they would suggest that such an investigation be initiated by the Prairie Provinces Water Board.

A plan of the overall Alberta-Saskatchewan project which the Alberta Government suggests for further investigation is included in the submission. It has been compiled from information available in the Water Resources Office and represents, in their opinion, the gravity irrigation project that, with further investigation may prove to be the best use of the water resources available in the Saskatchewan River basin.

To carry out such an investigation as above suggested, the Alberta Government considers that before topographic surveys are undertaken a soil survey should be undertaken in sufficient detail to eliminate all of those areas where the soil is unsuitable thus saving the cost and time of making the topographic surveys.

Characteristics of the Saskatchewan River Drainage Basin

The Saskatchewan River Drainage Basin consists of the area drained by the North and South Saskatchewan Rivers and tributaries.

The characteristics of the North and South Saskatchewan River basins are very similar. They are made up of many tributaries which rise in the icefields to the east of the Great Divide. The upper sections consist

almost entirely of the higher peaks, generally above the tree line. The foothill sections are well covered with forests which serve to hold the snow, thereby regulating the runoff. As the streams reach the prairies they flatten out and the rate of inflow becomes much less than from the upper reaches.

The South Saskatchewan River is made up of the following main streams together with many tributaries: The Waterton, Belly, St. Mary, Oldman, Little Bow, Highwood, Bow, and Red Deer Rivers.

These streams, with their tributaries, all join in Alberta to form the South Saskatchewan River, which, in Saskatchewan, is joined by a number of streams from the Cypress Hills. The stream is again joined by the North Saskatchewan River at a point below Saskatoon, to form the Saskatchewan River. The River then flows to Lake Winnipeg in Manitoba, and by the Nelson River, to the Hudson's Bay.

The North Saskatchewan River Drainage Basin is made up of the following main streams together with their tributaries:

The Clearwater, Brazeau, Sturgeon, Battle, Vermilion, and North Saskatchewan Rivers.

These streams all join in Alberta to form the North Saskatchewan River proper. The stream then flows into Saskatchewan where it is joined by the Battle and South Saskatchewan Rivers.

The following from the official hydrometric stream flow record will give some indication of the water supply of the Saskatchewan River Drainage Basin.

Saskatchewan River at The Pas—

Records from February 1913 to September 1937.

Drainage area	149,500 sq. mi.
Average annual run-off	18,000,000 ac.-ft.
Maximum rate of discharge recorded	103,000 c. f. s.
Minimum rate of discharge recorded	500 c. f. s.
Run-off per sq. mile of drainage area	120 ac.-ft.

North Saskatchewan River at Prince Albert—

Records from

Drainage area	46,100 sq. mi.
Average annual run-off	6,234,000 ac.-ft.
Maximum rate of discharge recorded	200,000 c. f. s.
Minimum rate of discharge recorded	400 c. f. s.
Run-off per sq. mile of drainage area	135 ac.-ft.

South Saskatchewan River at Medicine Hat—

Estimated

Drainage area	20,600 sq. mi.
Average annual run-off	5,484,115 ac.-ft.
Maximum rate of discharge recorded	145,000 c. f. s.
Minimum rate of discharge recorded	360 c. f. s.
Run-off per sq. mile of drainage area	266 ac.-ft.

North Saskatchewan River at Edmonton—

Drainage area	10,495 sq. mi.
Average annual run-off	5,621,000 ac.-ft.
Maximum rate of discharge recorded	204,500 c. f. s.
Minimum rate of discharge recorded	380 c. f. s.
Run-off per sq. mile of drainage area	535 ac.-ft.

The tributaries which flow from the mountains are permanent streams. Through the foothills in Alberta these streams flow in shallow valleys and have considerable fall. It is possible, therefore, to divert them by gravity canals to lands requiring irrigation on the higher benches. Throughout the eastern portion of Alberta and through the provinces of Saskatchewan and Manitoba, these streams flow in deep wide valleys from two to five hundred feet below the prairie level and cannot, therefore, be diverted by gravity to the general prairie levels.

There is a tremendous fluctuation between the maximum and minimum flows of the streams in the drainage basin. It is, therefore, important to all of the semi-arid and arid areas within the basin that the stream flow should be regulated and that water which now flows uselessly to the Hudson's Bay during high and flood stages, be stored and conserved in order to provide a satisfactory flow during the months of the year when the natural flow is low. Storage reservoirs can only be established where conditions are favourable, i.e. in the Saskatchewan drainage basin, mainly in the foothills of Alberta.

The past forty years have seen the depletion of what may be called a natural covering consisting firstly of prairie grass and secondly of forests, the latter having been depleted by logging operations and forest fires, and the former by grazing, cultivation and erosion. The result is that the run-off which formerly took place at seasons of the year which permitted direct irrigation from the rivers now occurs earlier in the year and in greater volume, not only making it more and more difficult to irrigate lands from the natural flow of the streams, but creating the conditions for disastrous floods and erosion.

Remedial measures which are now underway by the recently appointed East Slope Rocky Mountain Board, will have some beneficial effect over a long term of years, but large reservoirs will eventually be required in the headwaters to regulate the streams for both power and irrigation development and for flood control.

The area of the entire Saskatchewan River basin is 149,500 square miles or more than double the combined area of the Maritime Provinces. It contains most of the large centres of population, and a large percentage of the agricultural lands in Alberta and

Saskatchewan. Water development projects must, therefore, play a very important part in the agricultural and industrial development of the two provinces and of the country generally. The average annual discharge of the North and South Saskatchewan Rivers combined as they pass into Saskatchewan, is estimated at 13 million acre feet. The average annual flow of the Saskatchewan as it passes into Manitoba is estimated at about 18 million acre feet.

An estimate of 1,923,305 acres has been made for the ultimate development of irrigation in Alberta. The best estimate available for Saskatchewan is 925,000 acres. Together these give a total of 2,848,305 acres. Although the development of water power does not deplete the streams, it does decrease the summer flow and increase the winter flow.

In order to equitably allocate the interprovincial waters it will be necessary to make a comprehensive study of the available supplies and possible uses.

Jurisdiction Over the Administration of Interprovincial Streams

Prior to the transfer of the natural resources in 1930 from Canada to the respective provinces, there was a single administration of the water resources of the Prairie Provinces and the North West Territories. No conflict during that period of any description arose in any quarter as to the distribution or sharing of these resources. With the replacement of the united administration by divided ownership and control, after the transfer, it was realized that unless foresight was exercised, interprovincial difficulties might develop in respect to the use of the limited water resources available, thus giving rise to controversies and possible legal disputes similar in character to those which have been experienced with such obstructive consequences between state and state south of the International Boundary.

All of the important streams in Southern Alberta, with the exception of the Milk River, contribute to the drainage basins of streams which cover two or all three of the provinces of Manitoba, Saskatchewan and Alberta; they consist of the North and South Saskatchewan River drainage basins and tributaries, and the Battle River, which joins the North Saskatchewan River near Battleford. Other smaller streams which cross the Provincial boundary are Lodge, Middle and Battle Creeks, or tributaries of the Milk River, and Boxelder, Eyehill, Blackfoot, Bug Gully Creeks, as well as several other smaller streams.

As a measure designed to prevent the development of such controversy, a proposal for the formation of a Western Water Board was brought forward at the time

of the water resources transfer, in order to provide for the solution of interprovincial water problems.

Negotiations looking to the formation of the Board reached an advanced stage immediately after the transfer and an agreement embodying the proposal was signed by the Premiers of the three Prairie Provinces. The delay in the final consummation of the agreement was due to the impact of more pressing problems brought about by the depression. Further attempts to negotiate a satisfactory agreement at this time failed and the matter lay dormant until 1940.

Interprovincial Board

For the reason that the Manitoba Government became concerned with the effect of large water diversions in Alberta upon lake levels and water power possibilities in the lower reaches of the Saskatchewan River drainage basin, a Board composed of provincial members was initiated by that Province. A draft for an agreement between the provinces of Manitoba, Saskatchewan and Alberta was eventually prepared and finally completed in December, 1945.

The appointment of an Interprovincial Board, which followed, was not popular with the Dominion Government. The Minister of Resources for Canada in April, 1946, stated in Parliament that because the Prairie Provinces had set up an advisory water board, without inviting the Dominion to participate, the Federal Government was stepping out of the picture. This was taken by the opposition as an excuse by the Dominion Government for the Government to back down on its promises to provide irrigation works for the West. This caused a bitter debate in Parliament.

The main purposes of the Board established by the Provinces was to make, in co-operation with the Dominion Government Departments, a comprehensive overall study of the Saskatchewan River drainage basin, which the Board considered, should have been made years before, in order to determine the interrelationships between various developments which had been proposed from time to time with respect to various reaches of the Saskatchewan-Nelson River system, and the effects of the various proposed developments one upon another in the entire system. The Board, while it considered that although there was available a considerable amount of relevant information, such information was inadequate for such a study looking to economic development of the drainage basin as a whole and in the best public interests of the respective provinces and of Canada.

Dominion-Provincial Board

However, it was considered by the Provinces that if the statement of the Minister of Resources to the effect that the Dominion Government would step out of the irrigation picture unless represented on a Water Board, that a new Board would be formed which would include Dominion and Provincial representatives. Attached hereto is a copy of P.C. 2297 which provides for a Dominion-Provincial Board and to which is attached a copy of the agreement completed between Canada and the respective Provinces. It will be noted that Clause 2 is the important clause of the agreement. This provides as follows:

"The functions of the Board shall be to recommend the best use to be made of interprovincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta, and to recommend the allocation of water as between each such Province of streams flowing from one Province into another Province."

The result of it all was to place the Board in the position of allocating water to projects or Provinces before a comprehensive overall survey of the entire drainage basin was possible, in order to determine the best use of the available water supplies.

The following from a paper by D. M. Stephens, Deputy Minister of Mines and Resources for the Province of Manitoba, presented at the annual general meeting of the Engineering Institute of Canada, June 3rd, 1948, indicates the complexity of problems in the Saskatchewan Drainage Basin.

"I think it would be safe to say that the co-ordinated development of the water and related resources of the Saskatchewan River watershed represents one of the most important and one of the most complex problems in the field of resources management with which Canada is faced today. There are two national governments, three provincial governments, one state government and literally hundreds of municipal governments, each having its own general or special interest in the Saskatchewan River.

"There are as well, at least six separate and distinct geographic regions, each with its separate and distinct problems and possibilities relating to the control and use of water, not all of which are by any means compatible with others. First there is the mountain and foothills area where forest protection, power and storage will probably remain the dominant problems respecting the Saskatchewan River.

"Next there are the south-western prairie regions characterized by relatively steep river gradients, semi-arid climate, high summer temperatures, long growing seasons and, not the least important, populated by experienced irrigation farmers. These characteristics have been particularly favourable to irrigation. The steep slopes have made it possible, with a single dam and with a minimum of flooding damage, to command the maximum acreage solely by gravity. The climate has been favourable to irrigation not only because of the high summer temperatures and long growing seasons, but also because of the low precipitation which makes irrigation an annual necessity for the wide variety of cultivated crops grown in these localities. The steep river gradients which make it possible to command large land areas at relatively little cost also provide favourable conditions for the generation of hydro electric energy.

"Then comes the central prairie portion of the Saskatchewan River watershed. Through this region the Saskatchewan and its tributaries flow through relatively deep valleys, usually several hundred feet below the general prairie level and the river gradients are relatively flat. As the river flows easterly it passes through areas that have somewhat lower summer temperatures, higher annual precipitation and where dry-land farming is relatively less hazardous and where great difficulties would be encountered in using water either for irrigation or for power purposes.

"Between the prairie regions and Cedar Lake just above Lake Winnipeg, the river flows through a broad flat valley which is generally lightly wooded, but which is dotted with numerous shallow lakes and large open marshes. Throughout the eastern portion of the broad flat valley for many years the main economic return has been from aquatic fur bearing animals. These thrive in this immense marsh area wherein the water is periodically replenished as the Saskatchewan River overflows its low banks. Much of the eastern portion of this area is a flood plain or delta formation built up through the deposition of silt. During recent years two very interesting experiments have been going forward simultaneously in these portions of the Saskatchewan River delta or flood plain which lie between the Saskatchewan-Manitoba boundary and Cedar Lake."

Mr. Stephens in his presentation also stresses the importance of power development in the lower reaches of the Saskatchewan River and along the Nelson River.

The Alberta Government through its representative on the Board, prepared a list of projects authorized in Alberta under the provisions of the Irrigation and Water Resources Acts for recommendation of the Board. Attached herewith is a copy of O.C. 857/49 dated July 13, 1949, adopting the recommendation of the Board with respect to the Alberta projects. Similar action was taken by the Government of Manitoba at this time, but withheld by the Government of Saskatchewan until July 1951, when a list of Saskatchewan projects, authorized prior to the appointment of the Board, was submitted for consideration. Such a list of projects was adopted by the Government of Alberta by O.C. 1091/51 dated July 24, 1951.

A number of meetings of the Board were held during the above interval. The engineers employed by the Board in co-operation with Dominion and Provincial Departments prepared a very elaborate study of the available water supplies of the Saskatchewan drainage basin and the P.F.R.A. engineering organization proceeded with surveys and plans of the South Saskatchewan and William Pearce projects.

Through the Alberta representative of the Board the attitude of the Alberta Government with respect to allocating water for the William Pearce project in Alberta and the South Saskatchewan project in Saskatchewan was indicated to the Board from time to time.

Attached to this report is a copy of a letter dated February 14, 1950, by the Alberta representative on the Board to the Chairman of the Board anticipating the application by the Province of Saskatchewan to the Board for an allocation of water for the South Saskatchewan project. Engineers for the Water Resources Department of Alberta reviewed the plans, estimates and costs or proposal for separate Alberta and Saskatchewan projects, as against one overall Alberta-Saskatchewan project, and came to the conclusion that the one overall Alberta-Saskatchewan project should be recommended, in order to make the best use of inter-provincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta, or at least it was concluded that the allocation should be made to the South Saskatchewan River project until it was determined by further surveys, if necessary, what is the best use of these interprovincial waters.

Attached is a copy of the minutes of the meeting of the Board held September 5th, 1951, called to consider the allocation of water for the South Saskatchewan River project.

"When the question of allocation was considered, the Alberta representative took the view

that the two projects, the William Pearce and the South Saskatchewan, should be considered together in their merits and not from any Provincial point of view and that before allocations for either were made by the Board, one overall Alberta-Saskatchewan development should be further investigated and studied from the point of view of making the best use of the waters in the drainage basin."

As a result of the discussion which followed, the question of function of the Board arose. The representatives from Alberta and Manitoba supported the view that not only the available water supply must be taken into account, in considering allocations, but also the economics of the developments. The Saskatchewan representative, however, took the view that cost need not be considered and that it was nobody's concern except the Province affected what expenditure was necessary to make use of the water and that allocations should be made on the basis only of available water supply.

It was decided at the meeting that each Provincial representative should refer to his Government the terms of reference with respect to the functions of the Board for an interpretation of such functions.

With respect to the Alberta Government's interpretation the following is from a memorandum dated October 1, 1951, by the Minister in charge of Water Resources, who brought the matter to the attention of Council.

"It is our unanimous opinion that the terms of reference must of necessity include a study of the most beneficial use that can be made of the water."

With respect to other interpretations, the following are from letters by the Ministers of Agriculture for Saskatchewan and Canada respectively:

"The question of the Board's terms of reference apparently centered around the relation to the Board to the recently constituted Royal Commission. As you know, the Board, with the exception of the Saskatchewan representative, voted to postpone a decision on allocation until the Commission completes its report to the Federal Government, thus binding itself to the findings of the Commission. In my opinion this constitutes a breach of the spirit and terms of reference . . . Furthermore, the Water Board has the specific task of allocating waters in a comprehensive consideration of the factors involved while the Commission was set up

to investigate factors employing eventual investment decisions on the part of the Federal Government."

The above are quotations from a letter by the Minister of Agriculture for Saskatchewan. The following are from the Minister of Agriculture for Canada:

"My own point of view is that the authority given to the Board to study alternative uses of Water Resources had no particular project in mind.

"I do not think, however, that it was very anticipated that it would be the responsibility of any Province desiring to use water, which had been assigned to it, to first submit their plans to the Water Board.

"All we would be concerned about in a matter of that kind is the question as to whether the amount of which the Board had agreed any one of the Provinces was entitled to would take care of the project that we ourselves intended to finance. In my opinion the question as to whether we are going to finance it or not is one to be decided by the Government of Canada, and the Government of Canada would be quite capable of determining from the facts given to it by the Prairie Provinces Water Board as to whether there is sufficient water available.

"In short I do not think that the procedure followed by the Water Board at their last meeting was in agreement with the terms of the Order-in-Council, which set up the Prairie Provinces Water Board."

The foregoing is given to indicate the difference of opinions of Board members and their respective Minister.

In support of Alberta's contention that one overall Alberta-Saskatchewan project should be recommended, rather than two separate projects, or at least no allocation should be made to the South Saskatchewan project until it was determined by further surveys, if necessary, what is the best use of water, the following preliminary construction cost estimates were prepared by the Water Resources Department for the purposes of a rough comparison.

Separate Developments	\$134,000,000
Combined Development	96,367,000
Difference	\$ 37,633,000

The following is from a letter dated November 9, 1951, from the Alberta representative of the Water Board to the Chairman of that Board.

"It would seem to us that this difference, if justified at all, must be justified on by the development of water power incidental to the water power development.

"We have not had the construction details and other data to intelligently analyse the power features. However, from a study of the Cass-Begg Report, which is the only practical analysis of the power situation in Saskatchewan available to us here, we would conclude that a capital expenditure of not more than a quarter of \$37,633,000 could be justified from the net revenues available from the power development.

"However, the Royal Commission recently appointed to report on the South Saskatchewan project is composed partly of power experts who will probably be able to better assess the water power values."

Since the meeting of the Water Board, engineers of the Water Resources have given some further consideration to the type of project which would best serve the functions of providing irrigation for Alberta and Saskatchewan lands.

Activities of the Prairie Provinces Water Board

For purposes of dealing with applications to the Board the principal priority was adopted on the following basis:

First: Projects which are fully developed and for which water had been appropriated by the Federal Government prior to the Natural Resources Transfer Agreement.

Second: Projects which are fully developed and for which water had been appropriated by the Province concerned prior to July 28, 1948.

Third: The completion of projects which are partially developed and which can be fully and beneficially developed within the appropriations as "First" and "Second".

Fourth: The completion of projects with respect to which substantial works are now in existence and which works could, by the use of additional water and as shown by complete investigation, be made to serve larger areas in a beneficial manner involving allocations over and above those provided for by prior Dominion and Provincial allocations.

Fifth: Projects which are now under development by the Dominion and Provincial Governments and with respect to which an immediate beneficial use must be established in order to secure or protect our international allocation.

The first application dealt with by the Board was that of the Government of Alberta for the necessary

water for those projects for which water had been appropriated either by the Dominion or the Province.

Allocation for these projects was recommended by the Board and confirmed by Orders in Council by the Alberta and Manitoba Governments and by the Federal Government respectively. The date of the Alberta Order in Council was July 13, 1949. However, the Government of Saskatchewan delayed confirmation pending the completion of the investigation of the South Saskatchewan River Development, apparently with the intention of including this project along with those in Alberta and Saskatchewan for which water was allocated prior to the establishment of the Prairie Provinces Water Board.

The allocations requested for Alberta were made when the Board asked for them and these were before the Board prior to any other allocations. There was no new commitment in any of Alberta's requests as it was merely a summary of existing projects and water that had been appropriated over many years either by the Federal Government or by the Alberta Government.

The Board did approve a list of Saskatchewan projects similar to those requested for Alberta and for which water had been allocated by the Federal and Saskatchewan Governments prior to the existence of the Prairie Provinces Water Board. These were confirmed by Order in Council signed by the Lieutenant Governor of Alberta July 24, 1951, and the existing Alberta projects finally confirmed by Order in Council by the Government of Saskatchewan.

At a meeting of the Prairie Provinces Water Board at Regina, on the 5th and 6th of September, 1951, allocation for a supply of water from the South Saskatchewan Project was submitted to the Board. The Alberta representative on the Board presented a proposal for one overall Alberta-Saskatchewan project as an alternative to the two separate projects, one of which was the South Saskatchewan project under consideration.

The opinion was expressed by the Alberta representative of the Board as follows:

"When the matter of allocation of water for the South Saskatchewan Project was brought to the attention of the Board at a meeting held January 26th and 27th, I expressed the opinion that the two projects, the Red Deer Diversion project and the South Saskatchewan project should be considered together on their merits and not form any provincial point of view and that before allocations were considered for either of these projects, one overall Alberta-Saskatchewan development should be studied."

In the discussions which followed the functions of the Board were discussed. The Alberta representative argued that it was the responsibility of the members in considering allocation for projects, to take into consideration, not only available water supply, but also the economics of the projects which involves the cost of such projects and for that reason alternatives should be investigated before allocations were finalized. Members were requested by the Chairman to refer to their respective Governments the terms of reference for an interpretation of the "Functions of the Board".

The chairman stated that alternatives to the South Saskatchewan Project had already been investigated by P.F.R.A. and it was his understanding that the South Saskatchewan Project was the most economical proposal. However, in view of Mr. Russell's motion he was prepared to have the available data reviewed again.

A motion that whereas the Board has unanimously agreed there is sufficient water for this project the Board agree to reserve to the South Saskatchewan River Project 960,000 acre feet of water annually from the South Saskatchewan River, this reservation to be effective for a two year period was carried.

It is the opinion of the Alberta Government that the terms of reference to the Board must of necessity include a study of the most beneficial use that can be made of the water and that a reservation of the water for a two year period for the South Saskatchewan projects is all that is warranted under the present circumstances.

Analysis

Engineers of the P.F.R.A. and the Water Board made a review of the alternatives and came to the following conclusions:

First, cost is no criterion of economy. This has been borne out in the comparison of the combined and separate proposals. It has been shown that although the initial cost of the combined proposal is less, the separate proposal is much more desirable.

Engineers of the Water Resources do not agree with the review which was made and have prepared estimates from the best information available for comparative cost and find:

On the basis of capital cost for irrigation facilities only, the following is probably the best comparison which can be made at present:

Capital Cost—Separate developments	\$134,000,000
Capital Cost—Combined developments	96,367,000
Difference	37,633,000

Engineers of the Water Resources Department have done further investigation and in this submission they present a plan for one overall project which, in their opinion, should be investigated as an alternative to the two separate Alberta-Saskatchewan developments.

Further Investigations Suggested.

The plan proposed by the Water Resources engineers is a combination of various plans investigated by the various irrigation agencies, (see attached plan).

It is mainly the project proposed by William Pearce and investigated in 1921-22 by the Reclamation Service supplemented by later investigations and plans.

A. B. Cook, P.F.R.A. engineer, proposed the central section which reaches the land in Western Saskatchewan which can only be reached under a gravity canal by this means.

The P.F.R.A. investigations east of the South Saskatchewan River in Saskatchewan have supplied the information for those lands.

Other information has been taken from various topographic maps and plans available in the Water Resources Office.

Before any further topographical survey is considered, there should be a complete comprehensive soil survey of all areas considered satisfactory for irrigation from the preliminary survey work.

The preliminary soil survey as now issued differs very widely from the final soil surveys. This means considerable waste of time and money on topographic surveys on lands which are later rejected by the final soil survey. The Carmangay district of Alberta is a good example. Preliminary soil survey showed the lands satisfactory for irrigation, but later, after the plane topographic survey was completed the final soil survey showed the lands unsatisfactory.

If a sufficiently comprehensive soil survey were completed, immediately after the preliminary topographic work, so that any lands found to be suitable from a soil standpoint would, if found satisfactory from a topographic standpoint, only be reduced by the small amount due to irregularities in soil and topography by the final soil survey, then the topographic surveyors could complete their work knowing that the land surveyed would not be rejected at a later date. The time and money now used for topography could be well spent in a more comprehensive soil survey.

If this cannot be done prior to completion of the plane table work then a man skilled in soil survey should be added to the topographic survey party so that any land plane tabled would be suitable for soils. That is, there would be a minimum wastage of effort.

At present canals are designed on a purely topographic basis. If the area to be irrigated had the soil survey and topographic survey completed together than the canal location and design would be proper for the area.

The project proposed for further investigation includes a diversion from the North Saskatchewan to the Clearwater and another diversion of the North Saskatchewan River water and that of the Clearwater River into the Red Deer River.

In order to minimize the size of the main canal it is proposed that a storage site be investigated on the Red Deer River at the mouth of the Raven River. This site would provide additional storage on the Red Deer River upstream of the main diversion dam.

The main diversion dam requiring further investigation is the one proposed by the Reclamation Service, located in 38-25-w4. Its estimated length is 4,500 feet and its height 174 feet.

The headgates for the main canal are on the south side of the river and the main canal follows the river crossing it in a large syphon in 10-38-22-w4. This structure was estimated by the Reclamation Service to be 4,400 feet long and have a head of 300 feet. From here it goes southeastward into Sullivan Lake. This is the largest and cheapest storage available on the whole project. It commands nearly all the land which is considered to be suitable for irrigation in the Alberta section of the project.

The present main canal is proposed, instead of that located by the P.F.R.A., because it commands a greater area and hence no pumping is required. The P.F.R.A. canal follows low land and to reach over 50 per cent of the suitable land requires pumping. We believe that only in exceptional cases can irrigation be financially sound when pumping is required to reach the irrigable lands.

The reservoirs are large and have a small storage capacity in the P.F.R.A. plan. Sullivan Lake is a natural reservoir with a very large storage capacity.

The water for the Saskatchewan lands continues down Sounding Creek through various storage dams. These dams while providing drops for the water also provide storage for peak requirements. They also could be used as a source of power for pumping when and if it is found feasible to pump.

North of Macklin, Saskatchewan, the water is diverted from Eyehill Creek into a canal which carries it 55 miles into Eaglehill Creek. This canal requires three syphons and for part of the area it is through sandy soil.

On Eaglehill Creek are located Lake Reservoir, Tramping Lake Reservoir and Opuntia Lake Reservoir,

which provide storage to carry the peak irrigation requirements. All of these reservoirs are high enough to command the proposed irrigable area in the eastern part of Saskatchewan. A canal from Opuntia Lake skirting along the south side of Eaglehill Creek to near Rosetown, then turning down toward the White Bear Lake depression and thence around the north side of the Coteau bluffs would carry the irrigation water to the river crossing in the area near the Coteau damsite. A large and expensive syphon has been suggested as the means of crossing in this area.

The water crosses the river at an elevation such that the area suggested by the P.F.R.A. in the South Saskatchewan report is all covered by gravity. This eliminates the annual cost to the irrigators for lifting the water high enough to reach their lands.

Here again if it is deemed financially sound to pump to other lands in the area considerable pumping power might be found in the drops located near the east end of the syphon which drop the water for irrigation of the lower areas east of the river.

Water for irrigation in the Qu'Appelle valley would be supplied from the main canal going south from the east end of the syphon.

A larger area may be commanded from the high line canal east of the river, however we have confined the proposed investigation to those lands suggested by the P.F.R.A. The investigation would show whether sufficient water was available or whether these additional lands require irrigation.

There are certain lands in the area around Rosetown, which may not require irrigation, which are shown as commanded on the plan.

Mr. A. B. Cook, of the P.F.R.A. engineering staff, has made a proposal from reclamation surveys that seems worthy of further investigation. He suggests the canal in the vicinity of Youngstown be continued easterly to a natural reservoir site in Township 30, Range 1, West 4th Meridian. This site is 160 feet above the creek and has an estimated storage of some 300,000 acre feet. This reservoir would provide adequate storage close to the proposed area with a minimum of expense. From this reservoir A. B. Cook's main canal crosses the Cabrai valley on either one long syphon or possibly a couple of small ones. Once across this valley the canal passes through a series of small lakes to reach part of the commanded area. The land commanded in this area is not commanded by other proposals and can only be reached by gravity by a canal crossing the Cabrai valley in this area.

Adding this area to the project would tend to balance the area. This would give a large additional acreage of land in Saskatchewan that would be irrigable.

It would provide a band of irrigation in Saskatchewan from the 4th Meridian to east of Saskatoon. This additional area suggested by Mr. A. B. Cook has considerable merit and warrants further investigation.

It is obvious from the number of different proposals that have been made of the best use of this water that sufficient investigation has not been completed to determine which is the best plan. We, therefore, submit this proposal as the one that we consider shows the most promise and warrants further investigation prior to the construction of either two separate provincial projects or one overall combined Alberta-Saskatchewan project.

[DOCUMENTS ATTACHED]

Copy

O.C. 857/49.

Approved and Ordered,
(Signed) J. C. BOWEN,
Lieutenant Governor.

Edmonton, Wednesday, July 13th, 1949.

The Executive Council has had under consideration the report of the Honourable the Acting Minister of Agriculture, dated July 7th, 1949, stating that:

WHEREAS one of the functions of the Prairie Provinces Water Board is to recommend the allocation of the waters of Interprovincial streams; and

WHEREAS the said Board has accordingly recommended the allocations in the annual amounts indicated hereunder be granted to the Province of Alberta for diversion from the tributaries of the South Saskatchewan River for the following developed and partially developed irrigation projects:

Project	Classification	Irrigable Acres	Allocation in Ac. Ft.
St. Mary and Milk River Development.....	4 and 5	465,000	796,000
Western Irrigation District....	3	50,000	85,700
Eastern Irrigation District....	3	281,000	562,000
Bow River Irrigation Development.....	4	240,000	478,534
United Irrigation District....	3 and 5	34,000	51,000
Lethbridge Northern District	1	96,135	150,000
Mountain View Irrigation District.....	1 and 5	3,600	6,000
Leavitt Irrigation District....	3 and 5	4,400	7,000
Aetna Irrigation District....	3 and 5	7,300	13,000
Macleod Irrigation District....	3	5,000	8,000
Private Projects.....		70,000	80,000
Total.....		1,256,435	2,237,234

THEREFORE, upon the recommendation of the Honourable the Acting Minister of Agriculture, the Executive Council advises that the recommendations of the Prairie Provinces Water Board be and are hereby adopted by the Government of the Province of Alberta.

(Signed) ERNEST C. MANNING,
Chairman.

Copy

O.C. 1091/51.

Approved and Ordered,
(Signed) JOHN J. BOWLEN,
Lieutenant Governor.
Edmonton, Tuesday, July 24th, 1951.

The Executive Council has had under consideration the report of the Honourable the Minister of Agriculture, dated March 10th, 1951, stating that:

WHEREAS one of the functions of the Prairie Provinces Water Board is to recommend the allocation of the waters of Interprovincial streams; and

WHEREAS the said Board has accordingly recommended the allocations in the annual amounts indicated hereunder be granted to the Province of Saskatchewan from the indicated interprovincial drainage basins for the following developed and partially developed domestic, industrial, irrigation and municipal projects:

FINAL ALLOCATION

Project	Classification	Acre Feet Annually
<i>South Sask. Drainage Basin—</i>		
Small projects—		
Main stem.....	1 and 2	1,500
Tributaries.....	1 and 2	
<i>City of Saskatoon—</i>		
Municipal.....	1	11,426
Stem plant.....	1	31,260
Caron-Moose Jaw Diversion.....	2	12,600
Swift Current Irrigation Project.....	3	55,000
Swift Current Small Projects.....	1 and 2	5,600
<i>Qu'Appelle Drainage Basin—</i>		
Small projects.....	1 and 2	20,000
<i>Battle Creek Drainage Basin—</i>		
Small projects—		
Main stem.....	1 and 2	7,536
Tributaries.....	1 and 2	3,410
Richardson-McKinnon Project.....	1	3,054

FINAL ALLOCATION—*Conc.*

Project	Classification	Acre Feet Annually
<i>Middle Creek Drainage Basin—</i>		
Small projects.....	1 and 2	1,027
Middle Creek Reservoir losses.....	2	2,335
<i>Lodge Creek Drainage Basin—</i>		
Small projects.....	1 and 2	600
Spangler project.....	1 and 2	2,970
TENTATIVE ALLOCATION		
<i>South Saskatchewan Drainage Basin—</i>		
Regina-Moose Jaw Diversion.....		29,000
French Flata-Valley Park Projects.....		11,140
<i>Battle Creek Drainage Basin—</i>		
Small irrigation development—		
Main stem.....		1,000
Tributaries.....		1,000
Vidora Irrigation Project.....		3,360
Consul Irrigation Project extension.....		2,400

THEREFORE, upon the recommendation of the Honourable the Minister of Agriculture, the Executive Council advises that the recommendations of the Prairie Provinces Water Board, be and are hereby adopted by the Province of Alberta.

(Signed) ERNEST C. MANNING,
Chairman.

Copy

February 14th, 1950.

Mr. L. B. Thomson,
Director of Rehabilitation,
P.F.R.A.,
910 McCallum Hill Building,
Regina, Saskatchewan.

Dear Mr. Thomson:

Certain discussions at the recent meeting of the Prairie Provinces Water Board have given the writer cause for some alarm and considerable thought. The discussions referred to are—

First:—that discussion which followed as a result of Mr. Munroe's reference to the possibility of the Board allocating water for power purposes in Saskatchewan, and

Second:—from his reference to the possibility of making allocations to Provinces rather than to projects.

With regard to the first, the writer is able to appreciate the desire of Saskatchewan to have water allocated for power purposes in that Province and he can understand that unless water for power purposes as well as irrigation purposes is given, some definite standing, which standing can be protected by the Board, it might be very difficult if not impossible to attract capital for water development.

On the other hand, however, unless further development of irrigation in Alberta is greatly curtailed or an additional supply of water made available from the North Saskatchewan, the Athabaska, or both drainage basins, sufficient for such further development, it would be impossible for the Board to make or maintain definite allocations for power development until all the requirements for irrigation and other purposes are met.

The above discussions have prompted the writer to review briefly the history of the following two projects which might soon require the serious consideration of the Board. First, the North Saskatchewan or Red Deer Diversion project, and second, the South Saskatchewan River Development.

Most of the lands contained in these projects were originally in one combined development known as the North Saskatchewan Project. This project extended from a point on the North Saskatchewan River above Rocky Mountain House to Saskatoon in Saskatchewan. The project originally contained some 1,411,000 acres of irrigable lands and was estimated to cost approximately \$105,600,000 including the diversion of the North Saskatchewan and Clearwater Rivers. While a revision of unit prices would undoubtedly increase the costs of the project, the writer knows the unit prices adopted in 1921, when the estimates were made, were purposely made fairly high.

Assuming, however, that the estimated cost of \$105,600,000 is even only very approximately correct, then the Board when the time comes to seriously consider appropriations for the two above projects as now contemplated, should in the best interests of the best uses of water in the drainage basin as a whole, give serious consideration to one general overall Alberta-Saskatchewan project rather than two separate projects.

Regarding the matter of two separate projects as an alternative to one overall development, the writer is quite familiar with the early considerations given to the alternatives and was probably more instrumental than any other person for making the investigations which have led to the present status of the development. The following are some of the considerations referred to.

Although it is quite feasible to carry water by means of canals, natural channels and reservoirs, from the Red Deer River in Alberta as far as Saskatoon in

Saskatchewan, and it is the writer's opinion that it is quite feasible also to carry such water across to the east side of the South Saskatchewan River to the additional lands now included in the Saskatchewan Development, it was considered advisable for a number of reasons to divert water for the Saskatchewan lands directly from the South Saskatchewan River, if such diversion was found to be feasible and economical. There was, however, no thought in the writer's mind of constructing a huge and expensive dam as now contemplated and the only reason the writer had in mind for suggesting an alternative to the one Alberta-Saskatchewan development was the existence of the summit at the south end of Whitebear Lake between the North and South Saskatchewan Rivers drainage basin. It was considered that if by the construction of a dam some fifty to seventy feet in height across the South Saskatchewan River at a point about due north of Swift Current, South Saskatchewan River water could be diverted from the Whitebear Valley depression to the Eaglehill Creek drainage basin, the cost of such necessary diversion works might compare favourably with the saving which might be effected in the cost of main canal construction necessary to carry water to the Eaglehill Creek drainage basin from Alberta. That is, it was considered that if water for Saskatchewan lands could be carried into Saskatchewan by river channels rather than by canals, natural channels and reservoirs by the Sounding Creek, Eyehill Creek, Tramping Lake and Eaglehill Creek route at comparable costs than it would be desirable to have two separate developments rather than one.

Unless some economical diversion of the South Saskatchewan River in Saskatchewan can be made, then it is possible and the writer believes very probable, that the one combined Alberta-Saskatchewan Development will be much more economical than two separate developments.

However, whether or not the project is treated as one overall Alberta-Saskatchewan Development or two entirely separate developments, the writer is of the opinion that the Board in considering alternatives, should treat these developments more or less as one. The writer is convinced that if any priority is in the mind of any member of the Board, then the Alberta Development should be given such priority for a number of reasons, some of which are as follows:

First: Investigations were initiated in Alberta with respect to the irrigation of Alberta lands in what was called the North Saskatchewan project, long before the Saskatchewan Development was thought of, and at the request of the

P.F.R.A., a reservation was made by the Water Resources Office, for a water supply for the Alberta Development before the Saskatchewan Development was investigated or planned.

Second: The construction cost of the Alberta Development will be much less than the construction cost of the Saskatchewan Development.

Third: Very large areas within the Alberta Development have been abandoned as far as farming is concerned and other large areas are owned by the Government, all of which are excellent grazing lands. Irrigable tracts conveniently distributed throughout these large areas will be greatly benefited by irrigation and stock water supplies.

Alberta is somewhat handicapped with respect to the above project due to the fact that investigations and reports which have been undertaken by the P.F.R.A. are somewhat behind hand in comparison with similar investigations and reports of the Saskatchewan Development. However, it will be found when it is possible to make more intelligent comparisons of the two projects, that there are very good reasons why the Alberta project should take priority if any priority is considered.

However, as stated above, it is the writer's opinion that the two projects should be considered together on their merits and not from any provincial point of view. In that event it is the writer's opinion that one overall Alberta-Saskatchewan Development will likely be found to be desirable both from the point of view of cost and also from the best use of the available water supply.

With regard to an allocation of water for power purposes in Saskatchewan, it is the writer's opinion that this could not be considered until allocations for irrigation in Alberta were finally dealt with.

With regard to the matter of allocating water by provinces rather than by projects, the writer would like first to refer to certain quotations from the Engineering Journal of December, 1948, in which the papers presented at the annual General Meeting of the Institute are discussed. The following from a discussion by Mr. F. R. Burfield on page 647 is of interest.

"Actually what is being apportioned is not water, but Dominion Government aid. At the present time the costs of construction of irrigation undertakings is borne in very large part by the Dominion Government. There may be good political even statesmanlike reasons why the Federal aid should not be given entirely to one province,

even though the best or cheapest irrigation may be concentrated there. The practical result is that diversion of water is necessarily subservient to division of federal aid. This will be decided by politicians not by the Water Board."

The following is from a discussion by the writer on page 648.

"I do not think the function of the Board should or will be to apportion water by some rule as suspected by Mr. Burfield, but rather in the best interests of the drainage basin as a whole. I would hope that the Board in its recommendations would give consideration mainly to the most economical and beneficial uses of the waters to be apportioned. If however, there should be a tendency in the allocation of funds by provinces rather than by projects, then I think the Water Board would at least have the affect of curbing any such tendencies. A Board composed mostly of those who have to do with the actual administration of streams would be most competent to judge the merits or demerits of the respective projects and I believe that the recommendations of such a Board will be respected by Governments."

The writer would here like to review briefly the negotiations which led up to the appointment of the Prairie Provinces Water Board.

The province of Alberta, because of its more favourable location with respect to the drainage basin, is naturally not so concerned with waters which flow across the provincial boundaries as are the provinces of Saskatchewan and Manitoba. On the other hand, however, Alberta cannot consistently decline to participate in the formation of a Board such as the one recently set up, where such a Board is in the best interests of the provinces of Saskatchewan and Manitoba. However, the following thoughts were in the writer's mind throughout all negotiations which preceded the setting up of the present Board.

First:—Streams do not respect artificial boundaries. It is not practical, therefore, to endeavour to administer them provincially. The natural boundaries are the limits of the drainage basin and these are the only boundaries which should be considered in any overall and comprehensive plan of water development.

Second:—The Saskatchewan River Drainage Basin should be treated as a whole and not piece-meal. The best use should be made of the available water supplies in so far as possible by regions in the drainage basin rather than by provinces.

Third:—All commitments made by the respective provinces by virtue of authorizations, appropriations or reservations, should be treated as priorities and given some definite standing by the Board before allocating water for new projects.

It was with these thoughts in mind that the writer discussed with the Alberta authorities the advisability of co-operating with the other provinces of the Dominion in setting up a Water Board, and he is now somewhat alarmed by the trend of some of the thinking by some of the members of the Board. If as the writer believed, the purpose of the Board is to treat the drainage basins by regions rather than by provinces, and to recommend the allocation of water by projects where it can be best used within the drainage basins, that is one thing. However, if it is likely to be found impractical to do this and the Board is forced in its decision to consider the claims of the respective provinces ahead of other considerations, then that is another thing.

Possibly, the Board should give early consideration to the above alternatives before matters become further involved.

The writer here would like to make the position clear with respect to the use of water for the two projects—First, the North Saskatchewan-Red Deer Diversion Project, and second, the South Saskatchewan River Development.

As pointed out above, the Water Resources Office at the request of the P.F.R.A. has already made a reservation of water for the first project so that any water allocated for the second project must be over and above that amount of water as far as this office is concerned. Therefore, the Board before it considers the matter of allocating water for power purposes in Saskatchewan, should be quite sure of the amount of water then left in the stream for that purpose.

Yours very truly,

BEN RUSSELL,
Director of Water Resources.

PRAIRIE PROVINCES WATER BOARD

Minutes of Meeting at Regina, September 5 and 6, 1951

7-01 The meeting convened at 1.30 p.m. in Room 111A of the Hotel Saskatchewan in Regina. Present were:

Members of the Board

L. B. Thomson (Chairman)	E. J. Scammell
N. Marr	B. B. Hogarth
B. Russell	

Others

W. M. Berry (Engineering Secretary)	B. Boyson W. Stichling
A. G. Underhill	W. B. Clipsham
O. R. Hoover	N. E. Hartnett
H. L. Johnston	J. A. Arnot
E. E. Eisenhauer	

7-02 It was moved by Mr. Hogarth and seconded by Mr. Scammell that the minutes of the last meeting be approved—carried.

7-03 The Chairman announced that Mr. D. M. Stephens, former member of the Board for Manitoba, had been appointed by his Government to direct the work of the Manitoba Hydro-Electric Board and therefore that Government had appointed Mr. Hogarth to replace Mr. Stephens on the Board (Manitoba Order-in-Council 1100/51). Mr. Hogarth was then welcomed by the Chairman and the other Board members.

Mr. Marr suggested the Secretary should write Mr. Stephens expressing the Board's regret at having lost his support and counsel, but also expressing its congratulations on his new and important appointment. This suggestion was endorsed by all members.

7-04 The proposed agenda for the present meeting, as submitted by the Chairman, was approved.

7-05 The Chairman announced that the two recommendations made by the Board had been ratified by all Governments and were now final. These recommendations were:

Allocation to Alberta—recommended May 31, 1949—ratified by Canada Order-in-Council 4030/49; by Alberta Order-in-Council 857/49; by Manitoba Order-in-Council 1121/49; by Saskatchewan Order-in-Council 1307/51

Allocation to Saskatchewan—recommended February 15, 1951—ratified by Canada Order-in-Council 1874/51; by Alberta Order-in-Council 1091/51; by Manitoba Order-in-Council 1264/51; by Saskatchewan Order-in-Council 1310/51

7-06 The Secretary then reported on the organization and work of the Board's staff, stating—

1. The separate staff for the Board became an actuality when office space became available in Room 413, Post Office Building, Regina, about July 1, 1950.
2. Since that time the staff has consisted of the Secretary, one engineer, one stenographer and two draftsmen. One more engineer is vitally needed to supplement this organization.
3. Since its formation, three major reports on flow conditions in the Saskatchewan River basin have been issued. In addition, two memoranda were

prepared: one for the Saskatchewan Power Corporation on the effect of the proposed South Saskatchewan River Project on the hydro-electric power potential of its rivers, and the other for the Government of Saskatchewan on the effect of Alberta's request for an allocation on the proposed South Saskatchewan River Project. At present the staff is engaged in further studies of developments in the Saskatchewan River basin, in making a complete water supply and use study of the Qu'Appelle River basin, and investigating the water supply and use problems of the Cypress Hill's streams.

4. For the fiscal year ending March 31, 1952, the staff has been allocated \$20,000 from the P.F.R.A. appropriation. Estimated salaries for this period total nearly \$17,000 while travelling expenses and other charges will add to this figure.

The members then expressed their satisfaction with the work of the staff. The Chairman reminded the members that the Board's staff is completely separated from P.F.R.A. and is always ready for use by any of the provinces.

7-07 It was reported that Messrs. Thomson, Marr and Munroe were unable to contact the officials of the Department of Public Works as planned and set out in Minute 6-05. It was decided to leave this matter of navigation in abeyance.

7-08 The Secretary reported that, in accordance with Minutes 6-07, he had advised the printers to keep the mapping plates until further notice, had received delivery of the maps, had distributed the maps to the Board members in the numbers requested and had made recommendations for the public and private distribution of the maps, which recommendations were endorsed by correspondence by all Board members. These recommendations follow:

1. Only the 4- and 5-colour maps to be distributed outside the Board.
2. Reasonable requests from public agencies to be supplied without charge.
3. Requests from private sources to be referred to Secretary and, if reasonable, to be supplied at 75 cents per map.

7-09 Mr. Marr requested Messrs. Hoover and Johnston to report on the status of their new gauging stations.

Mr. Hoover read and presented a report dated August 28, 1951, which is attached to and made a part

of these minutes. Mr. Marr moved, seconded by Mr. Russell, that this report and its recommendations be adopted—carried.

Mr. Johnston read and presented a report dated August 21, 1951, which is attached to and made a part of these minutes. Mr. Marr moved, seconded by Mr. Hogarth, that this report be adopted—carried.

Mr. Marr pointed out the necessity of obtaining

- (a) additional information on northern Saskatchewan rivers and
- (b) assistance on the transportation problem by Saskatchewan Government aeroplanes similar to the assistance given by Manitoba. Mr. Scammell agreed to take this matter up with his Government and will make use of the Board's recommendations set out in Minute 4-06.

7-10 On procedural matters, Mr. Marr moved that in future all motions before the Board, do not necessarily require a seconder—carried.

7-11 The Secretary then suggested a revised method of allocating water for power; this suggestion is attached to and made a part of these minutes. The Board took exception to this sentence contained therein, "the Board would still, of course, have to approve proposed hydro-plants and might provide regulations controlling their manner of use." The Chairman appointed a subcommittee consisting of Messrs. Russell, Scammell, Hogarth, Marr and Berry to review and revise this proposal during the next recess.

After the recess, the subcommittee submitted their proposal which was:

That the Board made no recommendations for allocations of water for hydro-power developments but shall, pursuant to its functions under Section 2 of the Agreement, record all proposed hydro-power developments and may, if deemed necessary and advisable, make recommendations to the respective Governments governing the operations of any such developments.

This proposal was considered and adopted by the Board upon the motion of Mr. Russell.

7-12 The Secretary reviewed the progress being made by the staff on the Qu'Appelle River basin study: he mentioned the difficulties and distributed typical results. After discussion, the Secretary was instructed to proceed with the study.

7-13 The Secretary reviewed Water Board Report #3, "Preliminary Report on Effects of Certain Major Projects in the Saskatchewan River Drainage Basin", which had previously been distributed to the members in accordance with their instructions. The Board expressed their agreement with the conclusions set out

in this report. Mr. Hogarth pointed out, however, that this report assumed the Dauphin River Power Project as an individual project; with interconnection with steam and the Winnipeg River hydro plants, operation assumptions would change resulting in possible changes in the effect of upstream diversions.

7-14 The Chairman stated that the main purpose of this meeting was to consider the request for a recommended allocation for the South Saskatchewan River Project. He said the first application for this project had been considered on May 6, 1949; that due to insufficient data the requested water had been placed in the "reservation" class; that the P.F.R.A. had then prepared detailed reports on soils, climate, engineering, economics, etc. which had gone out to all Board members; that on December 18, 1950, the Board had considered a revised application from the Saskatchewan Government but, due to insufficient water supply information, had postponed action till this meeting; that since the last meeting the Secretary had distributed Water Board Report #3 containing the requested water supply information; that with the information now available he felt the Board was now in a position to act on this application. As he understood the Saskatchewan Government wished to again modify their request, he invited Mr. M. E. Hartnett, Deputy Minister of Agriculture, to address the Board.

Mr. Hartnett, speaking for the Minister of Agriculture, referred to Saskatchewan's previous applications, dated May 4, 1949 and November 8, 1950 for a recommended allocation. Due to recent information received, he presented a revised request as follows:

REVISION OF REQUIREMENTS FOR SOUTH SASKATCHEWAN RIVER PROJECT BASED ON THE REVISED SUMMARY REPORT OF INVESTIGATIONS

Net Irrigable Area	430,000 acres
18" duty, 80% Irrigation Factor 30% losses— $430,000 \times 1.5 \times 0.8$	
$\frac{0.7}{0.7}$ =	737,000 ac.-ft.
Reservoir Losses—Evaporation 21" on 70,000 acres	122,000 "
Seepage 57 c.f.s.	41,000 "
Total Requirements	900,000 "
Possible additional area about	40,000 acres
18" duty, 80% factor 20% losses— $40,000 \times 1.5 \times 0.8$	
$\frac{0.8}{0.8}$ =	60,000 ac.-ft.

Mr. Hartnett noted this revised application did not include a request for an allocation for power. He concluded by stating his Government feels that this

project has received more pre-construction study and investigation than any other known to it and that an immediate recommendation for allocation would be appreciated.

Then, upon invitation, Mr. E. E. Eisenhower, Sask. Deputy Minister of Public Works, stressed the urgency of getting this allocation recommended.

Mr. W. B. Clipsham, Chief Engineer of Sask. Power Corporation stated that he had nothing to add but then, in reply to a question by Mr. Russell, said he felt the Saskatchewan Government would never build the Coteau Dam for hydro-electric power production alone.

The Chairman thanked the visitors for their contribution and then ruled that the Board would immediately go into executive session. All visitors and assistants then retired.

7-15 In executive session the Board then gave full consideration to the allocation of water for the South Saskatchewan River Project. It was unanimously agreed that the water supply studies show there is sufficient water for the purposes of this project.

The Chairman asked members of the Board to consider the Saskatchewan Government application and a motion would be in order. Before the motion was received, however, Mr. Russell opened the discussion by suggesting that the alternate project of the North and South Saskatchewan project be considered and he filed a report for members to study. Mr. Russell believed that the combined project should be studied before an allocation was made by the Board. He also stated that he was not prepared to vote for a motion approving the application until such study was completed. He believed that as a Board member he was carrying out the function of the Board in determining the best use of water.

The question of procedure in receiving application was considered at some length by the Board. The Chairman agreed with Mr. Scammell that the proper procedure was to consider the Saskatchewan Government application, but in view of the nature of Mr. Russell's alternate proposal and his statement, it would be advisable to delay such procedure and have the economic aspects of this alternate proposal reviewed. The Chairman further stated that the matter of investigating this alternate project was one of Government Policy and the extent of further investigations had to be determined because there was no official request from the Alberta Government to have the combined project investigated to its ultimate conclusion. The Chairman also stated that alternatives to the South Saskatchewan River Project had already been investigated by the P.F.R.A. staff and it was his under-

standing that the South Saskatchewan River project was the most economical proposal. However, in view of Mr. Russell's position, he was prepared to have reviewed again the data available, and possibly this review could be presented at the Commission.

Mr. Russell stated that he was expressing his own views as a result of his experience and training. We had not discussed this combined proposal with the Alberta Government, but would do so on his return to Edmonton.

Mr. Scammell moved that, in view of the information received and of the fact that the necessary water is available, the Board now recommend an allocation for this project. Messrs. Hogarth and Marr felt that the Board should wait until it had received the report of the new Commission, appointed by the Government of Canada to investigate the economic and social aspects of the project, and to treat their report as additional evidence. Mr. Russell agreed with this view but added that he felt alternative methods of developing these resources, such as a combined South Saskatchewan-Red Deer Project, should be looked into, preferably by the new Commission. The motion was therefore defeated.

Mr. Hogarth then moved that, whereas the reservation previously made by the Board for this project has lapsed and whereas the Board has unanimously agreed there is sufficient water for this project, the Board agree to reserve to the South Saskatchewan River Project 960,000 acre-feet of water annually from the South Saskatchewan River—this reservation to be effective for a two-year period. In this discussion, Mr. Scammel stated he would vote for this motion only to preserve the position of the application—carried unanimously.

7-16 There was some discussion on the function of the Board, after which the Chairman ruled that in view of the present lack of unanimity and the difference in point of view by members of the Board as to its functions and duties, each member of the Board is requested to refer the terms of reference to his respective Government for clarification and to request the responsible minister of each Provincial Government to confer with the Federal Minister of Agriculture at an early date.

7-17 Some discussion took place as to whether the Agreement inferred that the Board should take cognizance of the Northwest Territories and its streams along, across, and in the vicinity of the prairie provinces. The Board agreed this was so.

7-18 Mr. Scammell then submitted a tabulation of existing and proposed hydro-electric power develop-

Royal Commission on South Saskatchewan River

ments in Saskatchewan for "recording" with the Board. This tabulation is attached to and made a part of these minutes.

7-19 The Secretary submitted, in accordance with Minute 6-13, his revised suggestions for amending the Agreement, these are attached to and made a part of these minutes. The Board concluded that the matter of amending the agreement should be held in abeyance.

7-20 The meeting adjourned on September 6th at 4:30 p.m.

Copy

P.C. 2297

Certified to be a true copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 19th day of JUNE, 1947.

WHEREAS the construction of water development projects in the Provinces of Alberta, Saskatchewan and Manitoba involves the use of inter-provincial waters;

AND WHEREAS no provision has been made for determining the allocation of the said waters between the provinces;

AND WHEREAS it is desirable that the most beneficial use be made of the available water resources of the three Prairie Provinces;

AND WHEREAS it is considered desirable by agreement with the Governments of the Prairie Provinces to establish a Board for the purpose of allocating the said waters and making recommendations as to their beneficial use:

THEREFORE His Excellency the Governor General in Council, on the recommendation of the Minister of Agriculture and the Acting Minister of Mines and Resources, is pleased to authorize and doth hereby authorize the Minister of Agriculture and Minister of Mines and Resources to execute the attached agreement with the three Prairie Provinces providing for the establishing of a Board to be known as "The Prairie Provinces Water Board".

(Sgd) A. D. P. HEENEY,
Clerk of the Privy Council.

The Honourable
The Minister of Agriculture

AGREEMENT

THIS AGREEMENT made this twenty-eighth day of July, A.D. 1948

BETWEEN :

THE GOVERNMENT OF CANADA, hereinafter called
"Canada"

AND

THE GOVERNMENT OF MANITOBA, hereinafter called
"Manitoba"

AND

THE GOVERNMENT OF SASKATCHEWAN, hereinafter
called "Saskatchewan"

AND

THE GOVERNMENT OF ALBERTA, hereinafter called
"Alberta"

1. Manitoba, Saskatchewan and Alberta and Canada agree to establish and there is hereby established a Board to be known as the Prairie Provinces Water Board to consist of five members to be appointed as follows:

- (a) two members to be appointed by the Governor General in Council, one on the recommendation of the Minister of Mines and Resources, and one, who shall be Chairman of the Board, on the recommendation of the Minister of Agriculture;
- (b) one member to be appointed by the Lieutenant Governor in Council of each of the Provinces of Manitoba, Saskatchewan and Alberta.

2. Functions

The functions of the Board shall be to recommend the best use to be made of interprovincial waters in relation to associated resources in Manitoba, Saskatchewan and Alberta and to recommend the allocation of water as between each such province of streams flowing from one province into another province.

3. Composition of Board

The members of the Board shall be chosen from those engaged in the administration of water resources or related duties for Manitoba, Saskatchewan, Alberta, or Canada, as the case may be, and shall serve as members of the Board in addition to their other duties.

4. Duties of Board

The duties of the Board shall be as follows:

- (a) to collate and analyse the data now available relating to the water and associated resources of interprovincial streams with respect to their utilization for irrigation, drainage, storage, power, industrial, municipal, navigation and other purposes;
- (b) to determine what other data are required from time to time in order to reach decisions on questions referred to it and to make recommendations

to the appropriate governmental organizations concerned for the carrying out of such field surveys, power investigations, soil surveys, establishment of gauging stations, economic studies relating to drainage and flood control and all similar work which the Board considers necessary to supply information required for the proper performance of its duties.

- (c) upon the request of anyone of the three provinces or the Dominion to recommend the allocation of the waters of any interprovincial stream among the respective Provinces;
- (d) to report on any questions relating to specific projects for the utilization or control of common river or lake systems at the request of one or more of the Ministers or authorities charged with the administration of such river or lake systems.

5. Confirmation of Board's Recommendations

A recommendation of the Board with respect to any matters referred to it under Subsection (c) and (d) of Section 4 hereof shall become effective when adopted by Orders in Council passed by Canada and by each of the Provinces affected thereby.

6. Authority of Board

The Board shall have authority to correspond with all governmental organizations and other sources of information in Canada or abroad concerned with the administration of water resources, and such other authority as may be conferred on the Board from time to time by agreement between the parties hereto; all agencies of the four governments having to do with the water and associated resources in the area covered by the Agreement shall be required to supply the Board with all data in their possession requested by the Board.

7. Records

The records relating to the water resources of the three Provinces collected and compiled by the P.F.R.A. organization at Regina shall be made available to the Board.

8. Meetings of the Board

The Board shall meet at the call of the Chairman and meetings shall be called at least twice annually, the expenses of the members shall be borne by their respective governments.

9. Reports

The Board shall submit an annual progress report outlining work done and work contemplated in the

agreed program to each of the responsible Ministers of the parties hereto and such other reports as may be requested by any one of such Ministers.

10. Staff and Location of Board Office

The Board shall employ a Secretary, who shall be a qualified engineer, with headquarters at Regina; if he is a Dominion Government employee he shall serve as Secretary as part of his regular duties; otherwise two-fifths of the salary of the Secretary shall be provided by Canada and one-fifth by each of the Provinces of Manitoba, Saskatchewan and Alberta; such technical and clerical staff, office accommodation and supplies as may be necessary shall be provided by the P.F.R.A. organization.

11. Each of the parties hereto agrees that it will not within the limits of its jurisdiction construct or permit the construction of any project that will interfere with the allocation of waters resulting from a recommendation of the Board duly adopted pursuant to Section 5 hereof.

12. Any water development project already constructed or to be constructed by any one of the parties hereto shall be so operated as to maintain as far as possible the allocation of water determined by the Board.

Signed on behalf of the Government of Canada by the Right Honourable James C. Gardiner, Minister of Agriculture and the Honourable James A. MacKinnon, Acting Minister of Mines and Resources, on behalf of the Government of Manitoba by on behalf of the Government of Saskatchewan by on behalf of the Government of Alberta by

Witnessed by:

D. W. ALLAN

JAMES GARDINER
*Minister of Agriculture for
Canada*

A. CEDAR

JAS. A. MACKINNON
*Acting Minister of Mines
and Resources for Canada*

D. M. STEPHENS

J. McDIARMID
*Minister of Mines and Natural
Resources for Manitoba*

C. A. L. HOGG

J. L. PHELPS
*Minister of Natural Resources
for Saskatchewan*

JESSIE ROSS

D. B. MACMILLAN
*Minister in Charge of Water
Resource and Irrigation for
Alberta*

[illegible]

MAP
SHOWING AREA OF CANADIAN PRAIRIES
SUITED FOR LARGE SCALE IRRIGATION

Designated as the
"DRY BOWL"

"DRY BOWL"
AVERAGE ANNUAL PRECIPITATION
AVERAGE MAXIMUM JULY TEMPERATURE
EXISTING IRRIGATION AREAS
PROPOSED IRRIGATION AREAS

Scale in miles

18 9 0 18 36 54 72

